

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT				1. CONTRACT ID CODE		PAGE 1 OF 5 PAGES	
2. AMENDMENT/MODIFICATION NO. 0001		3. EFFECTIVE DATE 27 AUG 98		4. REQUISITION/PURCHASE REQ. NO.		5. PROJECT NO. (If applicable)	
6. ISSUED BY Department of the Army Corps of Engineers Fort Worth District		CODE		7. ADMINISTERED BY (If other than Item 6)		CODE	
8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)				(✓)		9A. AMENDMENT OF SOLICITATION NO. DACA63-98-B-0041	
				×		9B. DATED (SEE ITEM 11) 31 JULY 1998	
						10A. MODIFICATION OF CONTRACTS/ORDER NO.	
						10B. DATED (SEE ITEM 13)	
CODE				FACILITY CODE			

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☒ is extended, ☐ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

(✓)	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor ☐ is not, ☐ is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)
The Solicitation for AMMO SUPPLY POINT IMPROVEMENTS AT MCGREGOR RANGE, FORT BLISS, TEXAS, is amended as follows:

See Continuation Sheet.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
15B. CONTRACTOR/OFFEROR		16B. UNITED STATES OF AMERICA	
_____ (Signature of person authorized to sign)		BY _____ (Signature of Contracting Officer)	
15C. DATE SIGNED		16C. DATE SIGNED	

NSN 7540-01-152-8070
PREVIOUS EDITION UNUSABLE
30-105-02
STANDARD FORM 30 (REV. 10-83)
Prescribed by GSA
FAR (48 CFR) 53.243
USAPPC V1.00

Item 14. Continued.

a. Standard Form 1442, First Page, Item 13.A.- In the second line, change the bid opening date from "1 September 1998" to "9 September 1998".

Bid opening time will be 2 p.m. local time.

b. Bidding Schedule.

Delete the note pertaining to the Bidding Schedule and add the accompanying new Bidding Schedule, bearing the notation "[AMEND 0001]".

c. Bidding Requirements and Contract Forms.

(1) Replace the Standard Form 1442 - SOLICITATION, OFFER, AND AWARD, with the attached Standard Form 1442.

(2) The following listed sections shall be voided and the accompanying new sections of the same title and number, each bearing the notation "ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NUMBER DACA63-98-B-0041" shall be substituted therefor:

SECTION 00100	INSTRUCTIONS, CONDITIONS, AND NOTICES TO BIDDERS
SECTION 00600	REPRESENTATIONS & CERTIFICATIONS
SECTION 00700	CONTRACT CLAUSES
SECTION 00800	SPECIAL CONTRACT REQUIREMENTS

d. Specifications.

(1) The following listed sections shall be voided and the accompanying new sections of the same title and number, each bearing the notation "[AMEND 0001]" shall be substituted therefor:

SECTION 02221	EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS
SECTION 02222	EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS
SECTION 02225	EARTHWORK FOR ROADWAYS, RAILROADS, AND AIRFIELDS
SECTION 02551	BITUMINOUS PAVING FOR ROADS, STREETS AND OPEN STORAGE AREAS
SECTION 02660	WATER SERVICE LINES
SECTION 02711	FOUNDATION DRAINAGE SYSTEM
SECTION 02720	STORM-DRAINAGE SYSTEM
SECTION 02721	SUBBASE COURSES
SECTION 02722	AGGREGATE BASE COURSE
SECTION 02730	SANITARY SEWERS
SECTION 04200	MASONRY
SECTION 05500	MISCELLANEOUS METAL
SECTION 06100	ROUGH CARPENTRY
SECTION 06200	FINISH CARPENTRY
SECTION 07160	BITUMINOUS DAMPPROOFING
SECTION 07270	FIRESTOPPING
SECTION 09250	GYPSUM WALLBOARD
SECTION 09310	CERAMIC TILE
SECTION 09445	RESINOUS TERRAZZO FLOORING

SECTION 09510	ACOUSTICAL CEILINGS
SECTION 09650	RESILIENT FLOORING
SECTION 09680	CARPET
SECTION 09900	PAINTING, GENERAL
SECTION 10160	TOILET PARTITIONS
SECTION 10440	INTERIOR SIGNAGE
SECTION 10800	TOILET ACCESSORIES
SECTION 13120	STANDARD METAL BUILDING SYSTEMS
SECTION 15250	THERMAL INSULATION FOR MECHANICAL SYSTEMS
SECTION 15320	FIRE PUMPS
SECTION 15330	WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION
SECTION 15400	PLUMBING, GENERAL PURPOSE
SECTION 15488	GAS PIPING SYSTEMS
SECTION 15569	WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20 MBTUH
SECTION 15653	AIR-CONDITIONING SYSTEM (UNITARY TYPE)
SECTION 15950	HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS

(2) The following listed accompanying new sections, each bearing the notation "[AMEND 0001]" shall be added to the specifications and add each to the Table of Contents:

SECTION 01510	- ENVIRONMENTAL PROTECTION
SECTION 02754	CONCRETE PAVEMENTS FOR SMALL PROJECTS
SECTION 16641	- CATHODIC PROTECTION SYSTEM (STEEL WATER TANKS)

(3) Delete the following sections:


SECTION 01410	ENVIRONMENT PROTECTION (This section is being replaced with 01510 ENVIRONMENT PROTECTION)
SECTION 02660A	WATER SERVICE LINES
SECTION 02761	FUEL-RESISTANT SEALING
SECTION 02761	FUEL-RESISTANT SEALING
SECTION 08390	BLAST RESISTANT DOORS
SECTION 08390	BLAST RESISTANT DOORS
SECTION 08390	BLAST RESISTANT DOORS
SECTION 09421A	TERRAZZO TILE
SECTION 09445A	RESINOUS TERRAZZO FLOORING
SECTION 09675	CONDUCTIVE VINYL FLOORING
SECTION 13210	ELEVATED STEEL WATER TANK
SECTION 13211	PRESSURE VESSELS FOR STORAGE OF COMPRESSED GASES
SECTION 13420	SELF-ACTING BLAST VALVES
SECTION 15845	ENERGY RECOVERY SYSTEMS
SECTION 15846	HEAT RECOVERY BOILERS
SECTION 15951	DIRECT DIGITAL CONTROL FOR HVAC

e. Drawings.

(1) The drawings listed below shall be voided and the attached new drawings of the same number, each bearing the notation "AM #0001, shall be substituted therefor:

Sequence No.	Sheet No.	Title
Seq 5	C3	Master Layout Plan
Seq 6	C4	Explosive Safety Clearance
Seq 7	C5	Phasing Plan
Seq 8	C6	Layout Plan
Seq 9	C7	Layout Plan
Seq 11	C9	Layout Plan
Seq 12	C10	Layout Plan
Seq 13	C11	Layout Plan
Seq 14	C12	Utility Plan Water/Sewer/Gas
Seq 15	C13	Utility Plan Water/Sewer/Gas
Seq 17	C15	Utility Plan Water/Sewer/Gas
Seq 21	C19	Paving Details
Seq 24	C22	Utility Details
Seq 27	C25	Sanitary Sewer Detail
Seq 29	A2	Ops. Building Addition Floor, Roof and Ceiling Plans & Details
Seq 30	A3	Salvage Office & POL Facility Floor Plan, Elevations & Sections
Seq 31	A4	Inert Storage Warehouse Floor Plan
Seq 32	A5	Inert Storage Warehouse Roof & Fire Protection Plan
Seq 33	A6	Guardhouse Floor Plan Elevation & Sections
Seq 34	A7	Operations Building Addition Elevations & Sections
Seq 36	A9	Inert Storage Warehouse Elevations & Sections
Seq 37	A10	Pumphouse Floor Plan Elevations & Details
Seq 38	A11	Typical Wall Section, Details, and Partitions
Seq 39	A12	Operations Building Addition Details
Seq 40	A13	Windows, Louver, & Misc. Details
Seq 41	A14	Guardhouse & Salvage Office Fire Protection Plan and Details
Seq 42	A15	Inert Storage Warehouse Typical Wall Section and Details
Seq 43	A16	Ops. Bldg. Addition, Guardhouse, Salvage Off., ISW, & Pumphouse Room
Seq 44	A17	Ammunition Surveillance Facility Floor Plan
Seq 45	A18	Ammunition Surveillance Facility Roof Plan
Seq 47	A20	Ammunition Surveillance Facility Sections
Seq 51	A24	Ammunition Surveillance Facility Details
Seq 53	A26	Ammunition Surveillance Facility Details
Seq 54	A27	Ammunition Surveillance Facility Details
Seq 56	A29	Ammunition Surveillance Room Finish Schedule
Seq 57	A30	Ammunition Surveillance Facility Door Schedule
Seq 58	A31	Ammunition Surveillance Facility Door Details
Seq 59	A32	Ammunition Surveillance Facility Door Details
Seq 60	S1	General Structural Notes & Typical Details
Seq 61	S2	Operations Bldg. Addition, Guardhouse & Salvage Yard Office Foundation
Seq 62	S3	Inert Sto. Warehouse Foundation Plan
Seq 63	S4	Operations Bldg. Addition, Guardhouse, Salvage Yard Off., & Inert Sto
Seq 64	S5	Operations Bldg. Addition, Guardhouse, Salvage Yard Off. & Inert Stor
Seq 66	S7	Operations Bldg. Addition, Guardhouse, Salvage Yard Off. Masonry & Mi
Seq 73	S14	Ammunition Surveillance Facility Test Cubical

Seq 78	S19	Ammunition Surveillance Facility Building Sections & Details
Seq 80	S21	Ammunition Surveillance Facility Sections & Details
Seq 81	S22	Ammunition Surveillance Facility Miscellaneous
Seq 83	S24	Magazine Plan & Sections
Seq 90	M2	Ammunition Surveillance Facility HVAC Equipment Schedules
Seq 91	M3	Salvage Yard Office, Guardhouse, & Pumphouse HVAC Plan
Seq 92	M4	Ammunition Surveillance Facility HVAC & Plumbing Details
Seq 93	M5	Ammunition Surveillance Facility HVAC Floor plan
Seq 94	M6	Ammunition Surveillance Facility HVAC Section & Details
Seq 95	M7	Ammunition Surveillance Facility Sanitary Waste & Vent Piping
Seq 96	M8	Ammunition Surveillance Facility Potable Water Piping
Seq 97	M9	Operations Building Addition HVAC Floor Plan
Seq 98	M10	Fire Protection Plan
Seq 99	M11	Fire Protection Details
Seq 100	M12	Fire Water System Fire Protection Plan
Seq 101	M13	Fire Protection Fire Detection & Alarm Riser Diagram
Seq 102	M14	Fire Protection Fire Water System Riser
Seq 103	E1	Operations Bldg. Addition, Guardhouse, Salvage Yard Office & Pumphou
Seq 104	E2	Inert Storage Warehouse Electrical Plan
Seq 105	E3	Operations Bldg. Addition, Guardhouse, Salvage Yard Off., & Inert St
Seq 106	E4	Ammunition Surveillance Facility Legend, & Lighting Fixture Schedule
Seq 107	E5	Ammunition Surveillance Facility One Line Diagram & Panel Schedules
Seq 108	E6	Ammunition Surveillance Facility - Lighting & Power Plan Schedules
Seq 109	E7	Ammunition Surveillance Facility Grounding and HVAC Power Plan
Seq 113	E11	Magazines - Electrical Plan & Sections
Seq 114	E12	Magazines - Electrical Details
Seq 119	E17	Electrical Pole Details
Seq 121	E19	Site Power Plan
Seq 122	E20	Security Lighting Plan I
Seq 124	E22	Security Lighting Plan III
Seq 125	E23	Security Lighting Plan IV

SOLICITATION, OFFER, AND AWARD <i>(Construction, Alteration, or Repair)</i>	1. SOLICITATION NUMBER	2. TYPE OF SOLICITATION <input type="checkbox"/> SEALED BID <i>(IFB)</i> <input type="checkbox"/> NEGOTIATED <i>(RFP)</i>	3. DATE ISSUED	PAGE OF PAGES
	IMPORTANT - The "offer" section on the reverse must be fully completed by the offeror.			
4. CONTRACT NUMBER	5. REQUISITION/PURCHASE REQUEST NUMBER	6. PROJECT NUMBER		
7. ISSUED BY	CODE	8. ADDRESS OFFER TO		
9. FOR INFORMATION CALL 		A. NAME	B. TELEPHONE NUMBER <i>(Include area code) (NO COLLECT CALLS)</i>	

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS *(Title, identifying number, date):*

11. The Contractor shall begin performance within _____ calendar days and complete it within _____ calendar days after receiving
☐ award, ☐ notice to proceed. This performance period is ☐ mandatory, ☐ negotiable. *(See _____.)*

12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE PAYMENT BONDS?

(If "YES," indicate within how many calendar days after award in Item 12B.)

☐ YES ☐ NO

12B. CALENDAR DAYS

13. ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and _____ copies to perform the work required are due at the place specified in Item 8 by _____ *(hour)*
local time _____ *(date)*. If this is a sealed bid solicitation, offers will be publicly opened at that time. Sealed envelopes
containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

B. An offer guarantee ☐ is, ☐ is not required.

C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.

D. Offers providing less than _____ calendar days for Government acceptance after the date offers are due will not be considered and will
be rejected.

OFFER (Must be fully completed by offeror)

14. NAME AND ADDRESS OF OFFEROR (Include ZIP Code)

15. TELEPHONE NUMBER (Include area code)

16. REMITTANCE ADDRESS (Include only if different than Item 14)

CODE

FACILITY CODE

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within _____ calendar days after the date offers are due. (Insert any number equal or greater than the minimum requirement stated in 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.)

AMOUNTS 

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGEMENT OF AMENDMENTS

(The offeror acknowledges receipt of amendments to the solicitation - give number and date of each)

AMENDMENT NO.

DATE

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER (Type or print)

20B. SIGNATURE

20C. OFFER DATE

AWARD (To be completed by Government)

21. ITEMS ACCEPTED

22. AMOUNT

23. ACCOUNTING AND APPROPRIATION DATA

24. SUBMIT INVOICES TO ADDRESS SHOWN IN
(4 copies unless otherwise specified)

ITEM

25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO

☐ 10 U.S.C. 2304(c) ()☐ 41 U.S.C. 253(c) ()

26. ADMINISTERED BY

CODE

27. PAYMENT WILL BE MADE BY

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE☐ 28. NEGOTIATED AGREEMENT (Contractor is required to sign this

document and return _____ copies to the issuing office.) Contractor agrees to furnish and deliver all items or perform all work requirements identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications incorporated by reference in or attached to this contract.

☐ 29. AWARD. (Contractor is not required to sign this document.) Your offer on this solicitation is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.

30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN
(Type or print)

31A. NAME OF CONTRACTING OFFICER (Type or print)

30B. SIGNATURE

30C. DATE

31B. UNITED STATES OF AMERICA

31C. AWARD DATE

BY

[AMEND 0001]

Ammunition Supply Point (Title)
Fort Bliss McGregor Range, New Mexico (Location)

Solicitation No. DACA63-98-B-0041

BIDDING SCHEDULE
(To be attached to SF 1442)

BASE BID: All work required by the plans and specifications exclusive of
work required by Option Bid Items.

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
0001	Basic Bid for Ammunition Supply Point Phase II With eight (8) ammunition magazines	Job	Sum	***	

TOTAL BASE BID \$ _____

[AMEND 0001]

Solicitation No. DACA63-98-B-0041

BIDDING SCHEDULE (cont)

0002 OPTION NO. 1 : Additional cost for all work required by
the plans and specifications for:

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
0002	One (1) additional ammunition magazine	Job	Sum	***	\$_____

TOTAL OPTION NO. 1 \$_____

0003 OPTION NO. 2 : Additional cost for all work required by
the plans and specifications for:

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
0003	One (1) additional ammunition magazine	Job	Sum	***	\$_____

TOTAL OPTION NO. 2 \$_____

0004 OPTION NO. 3 : Additional cost for all work required by
the plans and specifications for:

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
0004	One (1) additional ammunition magazine	Job	Sum	***	\$_____

TOTAL OPTION NO. 3 \$_____

0005 OPTION NO. 4 : Additional cost for all work required by
the plans and specifications for:

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
0005	One (1) 150,000 Galon Water Storage Tank	Job	Sum	***	\$_____

TOTAL OPTION NO. 4 \$_____

TOTAL BID BASE BID PLUS OPTIONS) \$_____

BIDDING SCHEDULE (cont)

NOTES:

1. ARITHMETIC DISCREPANCIES (EFARS 14.406-2)

(a) For the purpose of initial evaluation of bids, the following will be utilized in resolving arithmetic discrepancies found on the face of the bidding schedule as submitted by bidders:

- (1) Obviously misplaced decimal points will be corrected;
- (2) In case of discrepancy between unit price and extended price, the unit price will govern;
- (3) Apparent errors in extension of unit prices will be corrected; and
- (4) Apparent errors in addition of lump-sum and extended prices will be corrected.

(b) For the purposes of bid evaluation, the Government will proceed on the assumption that the bidder intends his bid to be evaluated on the basis of the unit prices, extensions, and totals arrived at by resolution of arithmetic discrepancies as provided above and the bid will be so reflected on the abstract of bids.

(c) These correction procedures shall not be used to resolve any ambiguity concerning which bid is low.

2. If a modification to a bid based on unit prices is submitted, which provides for a lump sum adjustment to the total estimated cost, the application of the lump sum adjustment to each unit price in the bid schedule must be stated. If it is not stated, the bidder agrees that the lump sum adjustment shall be applied on a pro rata basis to every unit price in the bid schedule.

3. Bidders must bid on all items.

4. Bidders must bid on all items on any schedule which is bid.

5. Costs attributable to Division 01 - General Requirements are assumed to be prorated among bid items listed.

6. Responders are advised that this requirement may be delayed, cancelled or revised at any time during the solicitation, selection, evaluation, negotiation and/or final award process based on decisions related to DOD changes in force structure and disposition of the Armed Forces.

[AMEND 0001]

BIDDING SCHEDULE (cont)

Solicitation No. DACA63-98-B-0041

NOTES: (cont)

7. For the purpose of this solicitation, the word "item" shall be considered to mean "schedule" as used in Provision 52.214-0019, CONTRACT AWARD--SEALED BIDDING--CONSTRUCTION, in Section 00100 INSTRUCTIONS, CONDITIONS, AND NOTICES TO BIDDERS, excluding additives, deductives, or optional items.

8. EVALUATION OF OPTIONS EXERCISED AT TIME OF CONTRACT AWARD (JUN 1988)
(FAR 52.217-4)

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate the total price for the basic requirement together with any option(s) exercised at the time of award.

9. OPTION FOR INCREASED QUANTITY - SEPARATELY PRICED LINE ITEM (MAR 1989)
(FAR 52.217-7)

The Government may require the completion of the numbered line item, identified in the Bidding Schedule as an option item, in the quantity and at the price stated in the Bidding Schedule. The Contracting Officer may exercise the option by written notice to the Contractor within the period specified in the Bidding Schedule. Completion of added items shall continue at the same schedule as the Base Bid unless otherwise noted in the SPECIAL CONTRACT REQUIREMENTS, paragraph 1 entitled COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK.

5. The Government reserves the right to exercise the option(s) either singularly or in any combination for up to 30 calendar days after award of the Base Bid without an increase in the Offeror's Bid Price.

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3	52.204-6	DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER (APR 1998)
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5	52.0-4000 ITB	NOTICE OF AVAILABILITY OF SOLICITATION PROVISIONS (52.0000-4000 ITB)
6	52.204-4004	REQUIRED CENTRAL CONTRACTOR REGISTRATION (MAR 1998)
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11	52.0-4072	BIDDER'S QUALIFICATIONS (52.0000-4072)
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13	52.0-4074	EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE (52.0000-4074)
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19	52.36-4002	AVAILABILITY OF UTILITY SERVICES (52.0036-4002)
20	52.36-4501	PERFORMANCE OF WORK BY CONTRACTOR (52.0036-4501)
21	52.204-7001	COMMERCIAL AND GOVERNMENT ENTITY (CAGE) CODE REPORTING (DEC 1991)
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ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NUMBER DACA63-98-B-0041

		IN DOD 5010.12-L, AND PLANS, DRAWINGS, AND OTHER PERTINENT DOCUMENTS (DEC 1991)(52.0210-4001 EBS)
23	52.211-2	AVAILABILITY OF SPECIFICATIONS LISTED IN THE DOD INDEX OF SPECIFICATIONS AND STANDARDS (DODISS) (JUN 1997)
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SECTION 00100

INSTRUCTIONS, CONDITIONS, AND NOTICES TO BIDDERS

1 52.0-4086 NOTIFICATION OF UNSUCCESSFUL BIDDERS (52.0000-4086)

Federal Acquisition Regulation (FAR) Subpart 14.409-1, Award of Unclassified Contracts, requires that the contracting officer notify each unsuccessful bidder in writing or electronically within three days after contract award.

This provision serves as your notice that the Ft. Worth District will post all contract award information for this solicitation electronically on the Fort Worth District Contracting Division Home Page located at <http://ebs.swf.usace.army.mil>. All bidders are required to review this page daily after bid opening for award information. We will not issue unsuccessful bidder letters in writing.

(End of Provision)

2 52.0-4085 PAYMENTS BY ELECTRONIC FUNDS TRANSFER (52.0000-4085)

1. Reference Federal Acquisition Regulation (FAR) Clause 52.232-34 Optional Information for Electronic Funds Transfer Payment.

2. Payments for any award resulting from this solicitation may be paid by Electronic Funds Transfer (EFT). While EFT is not mandatory at this time, it is highly recommended that the successful bidder provide information to the Disbursing Office to allow EFT.

3. The Direct Deposit Form and Instructions required to process payments for EFT can be found on the Fort Worth District home page at <http://www.swf.usace.army.mil/links/resource/finance.htm> or obtained from the contract specialist handling this solicitation.

(End of Provision)

3 52.204-6 DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER (APR 1998)

(a) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation "DUNS" followed by the DUNS number which identifies the offeror's name and address exactly as stated in the offer. The DUNS number is a nine-digit number assigned by Dun and Bradstreet Information Services.

(b) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one. A DUNS number will be provided immediately by telephone at no charge to the offeror. For information on obtaining a DUNS number, the offeror, if located within the United States, should call Dun and Bradstreet at 1-800-333-0505. The offeror should be prepared to provide the following information:

- (1) Company name.
- (2) Company address.
- (3) Company telephone number.
- (4) Line of business.
- (5) Chief executive officer/key manager.
- (6) Date the company was started.

(7) Number of people employed by the company.

(8) Company affiliation.

(c) Offerors located outside the United States may obtain the location and phone number of the local Dun and Bradstreet Information Services office from the Internet home page at <http://www.dnb.com/>. If an offeror is unable to locate a local service center, it may send an e-mail to Dun and Bradstreet at globalinfo@mail.dnb.com.

(End of provision)

AM #1 4 DELETED

5 52.0-4000 ITB NOTICE OF AVAILABILITY OF SOLICITATION PROVISIONS
(52.0000-4000 ITB)

Text of the referenced clauses can be found in the Federal Acquisition Regulations, Part 52, "Solicitation Provisions and Contract Clauses." The Federal Acquisition regulations are available (1) in the larger public libraries, (2) on the Internet (WEB site address <http://www.gsa.gov/far> or (3) may be purchased from the Superintendent of Documents, Congressional Sales Office, Government Printing Office, Washington, DC 20402. Upon award of a contract the complete text of the referenced clauses will be furnished to the Contractor.

(End of Provision)

6 52.204-4004 REQUIRED CENTRAL CONTRACTOR REGISTRATION (MAR 1998)

(a) Definitions.

As used in this clause--

(1) "Central Contractor Registration (CCR) database" means the primary DoD repository for contractor information required for the conduct of business with DoD.

(2) "Data Universal Numbering System (DUNS) number" means the 9-digit number assigned by Dun and Bradstreet Information Services to identify unique business entities.

(3) "Data Universal Number System +4 (DUNS+4) number" means the DUNS number assigned by Dun and Bradstreet plus a 4-digit suffix that may be assigned by a parent (controlling) business concern. This 4-digit suffix may be assigned at the discretion of the parent business concern for such purposes as identifying subunits of affiliates of the parent business concern.

(4) "Registered in the CCR database" means that all mandatory information, including the DUNS number of the DUNS+4 number, if applicable, and the corresponding commercial and Government Entity (CAGE) code, is in the CCR database; the DUNS number and the CAGE code have been validated; and all edits have been successfully completed.

(b) (1) By submission of an offer, the offeror acknowledges the requirement that a prospective awardee much be registered in the CCR database prior to award, during performance, and through final payment of any contract resulting from this solicitation, except for awards to foreign vendors for work to be performed outside the United States.

(2) The offeror shall provide its DUNS, or if applicable, its DUNS+4 number with its offer, which will be used by the Contracting Officer to verify that the offeror is registered in the CCR database.

(3) Lack of registration in the CCR database will make an offeror ineligible for award.

(4) DoD has established a goal of registering an applicant in the CCR database within 48 hours after receipt of a complete and accurate application via the Internet. However, registration of an applicant submitting an application through a method other than the Internet may take up to 30 days. Therefore, offerors that are not registered should consider applying for registration immediately upon receipt of this solicitation.

(c) The Contractor is responsible for the accuracy and completeness of the data within the CCR, and for any liability resulting from the Government's reliance on inaccurate or incomplete data. To remain registered in the CCR database after the initial registration, the Contractor is required to confirm on an annual basis that its information in the CCR database is accurate and complete.

(d) Offerors and contractors may obtain information on registration and annual confirmation requirements by calling 1-888-227-2423, or via the Internet at <http://ccr.edi.disa.mil>.

(End of clause)

7 52.0-4009 PROJECT INFORMATION (52.0000-4009)

A. For technical information regarding plans and specifications contact Fort Worth District Office, Corps of Engineers, Fort Worth, Texas, Mr. Ben Case at (817) 978-2378.

AM #1 B. For information regarding bidding procedures or bonds, contact Contracting Division, Mrs. Lisa Billman at (817) 978-4902, or visit Room 2A19, 819 Taylor Street, Fort Worth, Texas. Collect calls not accepted.

C. Bids will be publicly opened, at the time and date stated in the solicitation, in Room 2A20, 819 Taylor Street, Fort Worth, Texas.

D. Hand Carried Bids: Hand carried bids prior to 30 minutes before bid opening must be deposited in the "Bid Depository," Room 2A19, 819 Taylor Street, Fort Worth, Texas. Hand carried bids within 30 minutes of the stated bid opening time should be taken to the Bid Opening Room, Room 2A20, prior to the time stated for bid opening.

(End of Clause)

8 52.0-4010 GENERAL NOTICES (52.0000-4010)

a. In the technical specifications wherever the term "stabilized aggregate base course" is used, or wherever a reference is made to a section entitled "Stabilized Aggregate Base Course," it shall be deemed to mean "Aggregate Base Course."

b. Bidders must provide full, accurate, and complete information as required by this solicitation and its attachments. The penalty for making false statements in bids is prescribed in 18 USC 1001. (FAR 52.214-4)

c. The Affirmative Action Requirement of the Equal Opportunity Clause may apply to any contract resulting from this RFP.

d. Statements in technical section submittal paragraphs that "Submittals shall be submitted in accordance with the Section 01300: Submittals" shall be deemed to mean, "Submittals shall be submitted in accordance with Section 01300, SUBMITTAL PROCEDURES."

(End of Provision)

9 52.0-4049 PRINCIPAL CONTRACTING OFFICER (52.0000-4049)

The Contracting Officer who signs this contract will be the Principal Contracting Officer for this contract. However, any Contracting Officer assigned to the Fort Worth District, contracting within his or her authority, may take formal action on this contract when a contract action needs to be taken and the Principal Contracting Officer is unavailable.

10 52.0-4071 SUBMISSION OF BIDS VIA EXPRESS MAIL (52.0000-4071)

a. Your attention is directed to Federal Acquisition Regulation (FAR) 52.214-5 SUBMISSION OF BIDS, which requires that bids be addressed to the office specified in the solicitation, and show the time specified for receipt, the solicitation number, and the name and address of the bidder.

b. When using express mail services (i.e. Federal Express, Air Borne, Emery, etc.) other than the United States Postal Services Overnight Express, you must include the room number in the address, which requires delivery directly to a specific room. Failure to include the room number can cause delays, and could result in your bid being rejected as late.

11 52.0-4072 BIDDER'S QUALIFICATIONS (52.0000-4072)

Pursuant to FAR 9.1, before a bid is considered for award, the bidder may be requested by the Government to submit a statement regarding his previous experience in performing comparable work, his business and technical organization, financial resources, and plant available to be used in performing the work.

AM #1 12 DELETED

13 52.0-4074 EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE
(52.0000-4074)

Whenever a contract or modification of contract price is negotiated, the Contractor's cost proposals for equipment ownership and operating expenses shall be determined in accordance with the requirements of the Section 00800, EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE. A copy of EP 1110-1-8 "Construction Equipment Ownership and Operating Expense Schedule" is available for review at the Area/Resident Office herein before listed. Bidders/Contractors may purchase copies of EP 1110-1-8 (Volumes 1 through 12) by phoning (202) 783-3238, or by writing "Superintendent of Documents U.S. Government Printing Office, Washington, D.C. 20402." Major credit cards are accepted.

14 52.0-4075 NOTICE ON POTENTIAL EMPLOYMENT ON MILITARY INSTALLATION
(52.0000-4075)

If the work called for by this request for proposal is located on a military installation, offerors should check with post/base security to determine if potential employees will be allowed on the base/post to seek employment.

15 52.0-4076 PARTNERING (52.0000-4076)

In order to most effectively accomplish this contract, the government is encouraging the formation of a cohesive partnership with the contractor and its subcontractors. This partnership would strive to draw on the strengths of each organization in an effort to achieve a quality project done right the first time, within budget, and on schedule. This partnership would be bilateral in make-up and participation would be totally voluntary. Any cost associated with effectuating this partnership will be agreed to by both parties and will be shared equally with no change in contract price.

16 52.0-4077 SMALL BUSINESS AND SMALL DISADVANTAGED BUSINESS
SUBCONTRACTING PLAN (52.0000-4077)

Reference FAR 52.219-0009. The bidder/offeror shall take into consideration only those subcontracts which he/she will award when preparing the subcontracting plan required by the FAR.

17 52.36-4000 ESTIMATED CONSTRUCTION COST (52.0036-4000)

The estimated cost of the proposed construction is between \$5,000,000.00 and \$10,000,000.00.

18 52.236-27 SITE VISIT (CONSTRUCTION) (FEB 1995)

(a) The clauses at 52.236-2, Differing Site Conditions, and 52.236-3, Site Investigation and Conditions Affecting the Work, will be included in any contract awarded as a result of this solicitation. Accordingly, offerors or quoters are urged and expected to inspect the site where the work will be performed.

(b) Site visits may be arranged during normal duty hours by contacting:
Name: Fort Bliss Resident Office, U.S. Army Engineer District, Fort Worth,
Address: P. O. Box 6076, Fort Bliss, Texas 79906-2637, Telephone: (915)
568-2790 or (915) 568-7591.

(End of provision)

19 52.36-4002 AVAILABILITY OF UTILITY SERVICES (52.0036-4002)

Water, gas, and electricity are available from Government-owned and operated systems. See Section 00800 SPECIAL CLAUSES for details.

20 52.36-4501 PERFORMANCE OF WORK BY CONTRACTOR (52.0036-4501)

Unless he has submitted such description with his bid, the successful bidder must furnish the Contracting Officer within 20 days after award, a description of the work which he intends to perform with his own organization (e.g., earthwork, paving, brickwork, or roofing), the percentage of the total work this represents, and the estimated cost thereof.

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NUMBER DACA63-98-B-0041

21 52.204-7001 COMMERCIAL AND GOVERNMENT ENTITY (CAGE) CODE REPORTING
(DEC 1991)

(a) The Offeror is requested to enter its CAGE code on its offer in the block with its name and address. The CAGE code entered must be for that name and address. Enter CAGE before the number.

(b) If the Offeror does not have a CAGE code, it may ask the Contracting Officer to request one from the Defense Logistics Services Center (DLSC). The Contracting Officer will--

(1) Ask the Contractor to complete section B of a DD Form 2051, Request for Assignment of a Commercial and Government Entity (CAGE) Code;

(2) Complete section A and forward the form to DLSC; and

(3) Notify the Contractor of its assigned CAGE code.

(c) Do not delay submission of the offer pending receipt of a CAGE code.
(End of provision)

22 52.210-4001 EBS AVAILABILITY OF SPECIFICATIONS AND STANDARDS NOT
LISTED IN DODISS, DATA ITEM DESCRIPTIONS NOT LISTED IN
DOD 5010.12-L, AND PLANS, DRAWINGS, AND OTHER PERTINENT
DOCUMENTS (DEC 1991)(52.0210-4001 EBS)

Offerors may obtain the specifications, standards, plans, drawings, data item descriptions, and other pertinent documents cited in this solicitation by submitting a request to:

U.S. Army Corps of Engineers, Fort Worth

ATTN: CESWF-CT-M

819 Taylor, Room 2A19

Post Office Box 17300

Fort Worth, Texas 76102-0300

Include the number of the solicitation and the title and number of the specification, standard, plan, drawing, or other pertinent document. One electronic copy of the specifications, which include drawings, will be furnished on a compact disk free of charge to all those who submit the above information.

NOTE: Paper plans and specifications will not be issued on this solicitation.

(End of provision)

23 52.211-2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE DOD INDEX
OF SPECIFICATIONS AND STANDARDS (DODISS) (JUN 1997)

Single copies of specifications cited in this solicitation may be obtained by submitting a written request to the supply point listed below. The request must contain the title of the specification, its number, date, applicable amendment(s), and the solicitation or contract number. A telephone order entry system is available with the use of a touch tone telephone. A Customer Number is required to use this system and may be obtained by written request to the address listed below or by telephone (215-697-2179). In case of urgency, telegraphic requests are acceptable. Voluntary standards, which are not available to Offerors and Contractors from Government sources, may be obtained from the organization responsible for their preparation, maintenance, or publication.

Standardization Document

Order Desk, Building 4, Section D

700 Robbins Avenue

Philadelphia, PA 19111-5094

Facsimile No.....215-697-2978

(End of provision)

- 24 52.211-14 NOTICE OF PRIORITY RATING FOR NATIONAL DEFENSE USE (SEP 1990)

Any contract awarded as a result of this solicitation will be /___/ DX rated order; /X/ DO rated order certified for national defense use under the Defense Priorities and Allocations System (DPAS) (15 CFR 700), and the Contractor will be required to follow all of the requirements of this regulation.

(End of provision)

- 25 52.214-1 SOLICITATION DEFINITIONS--SEALED BIDDING (JUL 1987)

"Government" means United States Government.

"Offer" means "bid" in sealed bidding.

"Solicitation" means an invitation for bids in sealed bidding.

(End of provision)

- 26 52.214-3 AMENDMENTS TO INVITATIONS FOR BIDS (DEC 1989)

(a) If this solicitation is amended, then all terms and conditions which are not modified remain unchanged.

(b) Bidders shall acknowledge receipt of any amendment to this solicitation (1) by signing and returning the amendment, (2) by identifying the amendment number and date in the space provided for this purpose on the form for submitting a bid, (3) by letter or telegram, or (4) by facsimile, if facsimile bids are authorized in the solicitation. The Government must receive the acknowledgment by the time and at the place specified for receipt of bids.

(End of provision)

- 27 52.214-4 FALSE STATEMENTS IN BIDS (APR 1984)

Bidders must provide full, accurate, and complete information as required by this solicitation and its attachments. The penalty for making false statements in bids is prescribed in 18 U.S.C. 1001.

(End of provision)

(R 2-201(b)(xiii))

(R 1-2.201(a)(11))

- 28 52.214-6 EXPLANATION TO PROSPECTIVE BIDDERS (APR 1984)

Any prospective bidder desiring an explanation or interpretation of the solicitation, drawings, specifications, etc., must request it in writing soon enough to allow a reply to reach all prospective bidders before the submission of their bids. Oral explanations or instructions given before the award of a contract will not be binding. Any information given a prospective bidder concerning a solicitation will be furnished promptly to all other prospective bidders as an amendment to the solicitation, if that

information is necessary in submitting bids or if the lack of it would be prejudicial to other prospective bidders.

(End of provision)
(R SF 33A, Para 3, 1978 JAN)

29 52.214-7 LATE SUBMISSIONS, MODIFICATIONS, AND WITHDRAWALS OF
BIDS (MAY 1997)

(a) Any bid received at the office designated in the solicitation after the exact time specified for receipt will not be considered unless it is received before award is made and it--

(1) Was sent by registered or certified mail not later than the fifth calendar day before the date specified for receipt of bids (e.g., a bid submitted in response to a solicitation requiring receipt of bids by the 20th of the month must have been mailed by the 15th);

(2) Was sent by mail (or telegram or facsimile, if authorized) or hand-carried (including delivery by a commercial carrier) if it is determined by the Government that the late receipt was due primarily to Government mishandling after receipt at the Government installation;

(3) Was sent by U.S. Postal Service Express Mail Next Day Service-Post Office To Addressee, not later than 5:00 P.M. at the place of mailing two working days prior to the date specified for receipt of bids. The term "working days" excludes weekends and U.S. Federal holidays; or

(4) Was transmitted through an electronic commerce method authorized by the solicitation and was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of bids.

(b) Any modification or withdrawal of a bid is subject to the same conditions as in paragraph (a) of this provision.

(c) The only acceptable evidence to establish the date of mailing of a late bid, modification, or withdrawal sent either by registered or certified mail is the U.S. or Canadian Postal Service postmark both on the envelope or wrapper and on the original receipt from the U.S. or Canadian Postal Service. Both postmarks must show a legible date or the bid, modification, or withdrawal shall be processed as if mailed late. "Postmark" means a printed, stamped, or otherwise placed impression (exclusive of a postage meter machine impression) that is readily identifiable without further action as having been supplied and affixed by employees of the U.S. or Canadian Postal Service on the date of mailing. Therefore, bidders should request the postal clerk to place a legible hand cancellation bull's-eye postmark on both the receipt and the envelope or wrapper.

(d) The only acceptable evidence to establish the time of receipt at the Government installation is the time/date stamp of that installation on the bid wrapper or other documentary evidence of receipt maintained by the installation.

(e) The only acceptable evidence to establish the date of mailing of a late bid, modification, or withdrawal sent by U.S. Postal Service Express Mail Next Day Service-Post Office to Addressee is the date entered by the post office receiving clerk on the "Express Mail Next Day Service-Post Office to Addressee" label and the postmark on the envelope or wrapper and on the original receipt from the U.S. Postal Service. "Postmark" has the same meaning as defined in paragraph (c) of this provision, excluding postmarks of the Canadian Postal Service. Therefore, bidders should request the postal clerk to place a legible hand cancellation bull's-eye postmark on both the receipt and the envelope or wrapper.

(f) Notwithstanding paragraph (a) of this provision, a late modification of an otherwise successful bid that makes its terms more favorable to the Government will be considered at any time it is received and may be accepted.

(g) Bids may be withdrawn by written notice or telegram (including mailgram) received at any time before the exact time set for receipt of bids. If the solicitation authorizes facsimile bids, bids may be withdrawn via facsimile received at any time before the exact time set for receipt of bids, subject to the conditions specified in the provision entitled "Facsimile Bids." A bid may be withdrawn in person by a bidder or its authorized representative if, before the exact time set for receipt of bids, the identity of the person requesting withdrawal is established and the person signs a receipt for the bid.

(h) If an emergency or unanticipated event interrupts normal Government processes so as to cause postponement of the scheduled bid opening, and urgent Government requirements preclude amendment of the solicitation or other notice of an extension of the opening date, the time specified for receipt of bids will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume.

(End of provision)

30 52.214-18 PREPARATION OF BIDS--CONSTRUCTION (APR 1984)

(a) Bids must be (1) submitted on the forms furnished by the Government or on copies of those forms, and (2) manually signed. The person signing a bid must initial each erasure or change appearing on any bid form.

(b) The bid form may require bidders to submit bid prices for one or more items on various bases, including--

- (1) Lump sum bidding;
- (2) Alternate prices;
- (3) Units of construction; or
- (4) Any combination of subparagraphs (1) through (3) above.

(c) If the solicitation requires bidding on all items, failure to do so will disqualify the bid. If bidding on all items is not required, bidders should insert the words "no bid" in the space provided for any item on which no price is submitted.

(d) Alternate bids will not be considered unless this solicitation authorizes their submission.

(End of provision)

(R SF 22, Para 5, 1978 FEB)

31 52.214-19 CONTRACT AWARD--SEALED BIDDING--CONSTRUCTION (AUG 1996)

(a) The Government will evaluate bids in response to this solicitation without discussions and will award a contract to the responsible bidder whose bid, conforming to the solicitation, will be most advantageous to the Government, considering only price and the price-related factors specified elsewhere in the solicitation.

(b) The Government may reject any or all bids, and waive informalities or minor irregularities in bids received.

(c) The Government may accept any item or combination of items, unless doing so is precluded by a restrictive limitation in the solicitation or the bid.

(d) The Government may reject a bid as nonresponsive if the prices bid

are materially unbalanced between line items or subline items. A bid is materially unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated in relation to cost for other work, and if there is a reasonable doubt that the bid will result in the lowest overall cost to the Government even though it may be the low evaluated bid, or if it is so unbalanced as to be tantamount to allowing an advance payment.

(End of provision)

32 52.214-31 FACSIMILE BIDS (DEC 1989)

(a) Definition. "Facsimile bid," as used in this solicitation, means a bid, modification of a bid, or withdrawal of a bid that is transmitted to and received by the Government via electronic equipment that communicates and reproduces both printed and handwritten material.

(b) Bidders may submit facsimile bids as responses to this solicitation. These responses must arrive at the place and by the time, specified in the solicitation.

(c) Facsimile bids that fail to furnish required representations or information or that reject any of the terms, conditions, and provisions of the solicitation may be excluded from consideration.

(d) Facsimile bids must contain the required signatures.

(e) The Government reserves the right to make award solely on the facsimile bid. However, if requested to do so by the Contracting Officer, the apparently successful bidder agrees to promptly submit the complete original signed bid.

(f) Facsimile receiving data and compatibility characteristics are as follows:

(1) Telephone number of receiving facsimile equipment: (817) 978-3166.

(2) Compatibility characteristics of receiving facsimile equipment (e.g., make and model number, receiving speed, communications protocol):

AM # 1 Digital Facsimile Transceiver; Make: Hewlett Packard; Model: 900;
Compatibility: CCITT Group 2 and 3; Communications: Half Duplex.

(g) If the bidder chooses to transmit a facsimile bid, the Government will not be responsible for any failure attributable to the transmission or receipt of the facsimile bid including, but not limited to, the following:

- (1) Receipt of garbled or incomplete bid.
- (2) Availability or condition of the receiving facsimile equipment.
- (3) Incompatibility between the sending and receiving equipment.
- (4) Delay in transmission or receipt of bid.
- (5) Failure of the bidder to properly identify the bid.
- (6) Illegibility of bid.
- (7) Security of bid data.

(End of provision)

33 52.214-4000 CONTRACT CLAUSE AND SOLICITATION PROVISION NUMBERING
(JAN 1990) (52.0214-4000)

This document is computer generated by the Standard Army Automated Contracting System (SAACONS). The numbering system used by the computer for contract clauses and solicitation provisions differs slightly from the procurement regulations. It is similar and easily recognizable. The Federal Acquisition Regulation (FAR) numbering format for contract clauses and solicitation provisions is 52.2xx-x, with the

specific FAR provision or clause number being a sequence assigned within each section or subpart 52.2. SAACONS always uses a 9 digit number (e.g. 52.2XX.XXXX).

FAR contract clauses and solicitation provisions are recognized by a "0" in the 6th digit of the SAACONS number. Department of Defense Federal Acquisition Regulation Supplement (DFARS) contract clauses and solicitation provisions are recognized by a "7" in the 6th digit of the SAACONS number. Army Federal Acquisition Regulation Supplement (AFARS) contract clauses and solicitation provisions are recognized by a "9" in the 6th digit of the SAACONS number. Engineer Federal Acquisition Regulation Supplement (EFARS) contract clauses and solicitation provisions and local instructions and provisions which were previously referred to by paragraph number only, now appear as "local clauses" with local clause numbers. They are recognizable by a "4" in the 6th digit of the SAACONS number. The word "(EFARS)" will appear in parenthesis at the end of the title of the clause/provision from that supplement; The word "(Local)" will appear in like manner to identify local implementation. (FAR, DFARS AND AFARS clauses and provisions that have recently been modified or added may also be numbered as local clauses pending their integration into the SAACONS database by the SAACONS contractor. Until the integration is complete the title line will identify the regulatory source. Examples of the difference in the numbering are provided below:

STANDARD NUMBERING SYSTEM		SAACONS
FAR	52.227-1	52.227-0001
DFARS	252.243-7000	52.243-7000
AFARS	52.237-9030	52.237-9030
EFARS	52.202-10001	52.202.4001 E
LOCAL	NONE	52.XXX.4XXX L

Authorized alternate versions of the clauses are sometimes used, and are identified in the applicable regulation by sequential Roman numeral identifiers. When an alternate version is used the SAACONS clause number will be followed by the appropriate Roman numeral identified. For example, FAR Clause 52.202-1 in its Alternate I version is entitled "DEFINITIONS (APR 1984)--ALTERNATE I (APR 1984)". The clause number will appear as "52.202-1 I". An Alternate II version of a clause would appear as "52.xxx-xxxx II".

34 52.214-4005 SUBMISSION OF BIDS (MAR 1997) (52.214-4005)

(a) Bids and bid modifications shall be submitted in sealed envelopes or packages (unless submitted by electronic means) (1) addressed to the office specified in the solicitation, and (2) showing the time specified for receipt, the solicitation number, and the name and address of the bidder.

(b) Bidders using commercial carrier services shall ensure that the bid is addressed and marked on the outermost envelope or wrapper as prescribed in subparagraphs (a)(1) and (2) of this provision when delivered to the office specified in the solicitation.

(c) Telegraphic bids will not be considered unless authorized by the solicitation; however, bids may be modified or withdrawn by written or telegraphic notice.

(d) Facsimile bids, modifications, or withdrawals, will not be considered unless authorized by the solicitation.

(e) Bids submitted by electronic commerce shall be considered only if the electronic commerce method was specifically stipulated or permitted by the solicitation.

(End of provision)

NOTICE: REFERENCE PARAGRAPH (c) ABOVE, PROVISION ENTITLED "SUBMISSION OF BIDS". TELEGRAPHIC BIDS ARE NOT AUTHORIZED. THE U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT, DOES NOT HAVE A TELETYPE NUMBER. IF A BID MODIFICATION OR WITHDRAWAL MUST BE SUBMITTED BY TELEGRAM, THEN BIDDERS MUST COORDINATE WITH WESTERN UNION FOR TIMELY DELIVERY. THE GOVERNMENT ASSUMES NO RESPONSIBILITY FOR LATE BID MODIFICATION OR WITHDRAWAL.

35 52.214-4208 AMENDMENTS OF INVITATION FOR BIDS (52.0214-4208)

Pursuant to FAR 14.208, the right is reserved, as the interest of the Government may require, to revise or amend the specifications or drawings or both prior to the date set for opening of bids. Such revisions and amendments, if any, will be announced by an amendment or amendments to this Invitation for Bids. If revisions and amendments are of a nature which requires material changes in quantities or bid prices or both, the date set for opening bids may be postponed by such number of days, as in the opinion of the issuing officer, will enable bidders to revise their bids. In such cases, the amendment will include an announcement of the new date for opening bids.

36 52.228-4203 SPECIAL NOTICE CONCERNING INDIVIDUAL SURETIES (FEB 1990) (52.0228-4203)

The Security interest, including pledged assets as set forth in the contract clause entitled "PLEDGES OF ASSETS", and executed Standard Form 28 entitled "AFFIDAVIT OF INDIVIDUAL SURETY" shall be furnished with the bond. FAILURE TO PROVIDE WITH THE BID BOND A PLEDGE OF ASSETS (SECURITY INTEREST) IN ACCORDANCE WITH FAR 28.203-1 WILL RESULT IN REJECTION OF A BID WHICH IS BONDED BY INDIVIDUAL SURETIES.

37 52.233-2 SERVICE OF PROTEST (AUG 1996)

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from

Chief, Contracting Division
U.S. Army Engineer District, Fort Worth
819 Taylor Street, Room 2A19
Fort Worth, Texas 76102-0300

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

(End of provision)

38 52.236-7008 CONTRACT PRICES--BIDDING SCHEDULES (DEC 1991)

(a) The Government's payment for the items listed in the Bidding Schedule shall constitute full compensation to the Contractor for--

(1) Furnishing all plant, labor, equipment, appliances, and materials;
and

(2) Performing all operations required to complete the work in conformity with the drawings and specifications.

(b) The Contractor shall include in the prices for the items listed in the Bidding Schedule all costs for work in the specifications, whether or not specifically listed in the Bidding Schedule.

(End of provision)

39 52.228-4001 BID GUARANTEE (SEP 1996) (52.228-4001)

(a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.

(b) The bidder shall furnish a bid guarantee in the form of a firm commitment, e.g., bid bond supported by good and sufficient surety or sureties acceptable to the Government, postal money order, certified check, cashier's check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid guarantees, other than bid bonds, (1) to unsuccessful bidders as soon as practicable after the opening of bids, and (2) to the successful bidder upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.

(c) The amount of the bid guarantee shall be twenty (20) percent of the bid price or \$3,000,000, whichever is less.

(d) If the successful bidder, upon acceptance of its bid by the Government within the period specified for acceptance, fails to execute all contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the bidder, the Contracting Officer may terminate the contract for default.

(e) In the event the contract is terminated for default, the bidder is liable for any cost of acquiring the work that exceeds the amount of its bid, and the bid guarantee is available to offset the difference.

FAILURE TO INCLUDE BID BOND OR OTHER BID SECURITY ON TIME MAY BE CAUSE FOR REJECTION OF THE BID AS NONRESPONSIVE. LATE BOND OR OTHER SECURITY WILL BE TREATED IN THE SAME MANNER AS PROVIDED IN THIS SOLICITATION FOR LATE BIDS. FACSIMILE BONDS ARE NOT ACCEPTABLE.

(End of provision)

END OF SECTION 00100

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SECTION 00600

REPRESENTATIONS & CERTIFICATIONS

1 52.203-2 CERTIFICATE OF INDEPENDENT PRICE DETERMINATION (APR 1985)

(a) The offeror certifies that--

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to (i) those prices, (ii) the intention to submit an offer, or (iii) the methods or factors used to calculate the prices offered;

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory--

(1) Is the person in the offeror's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above; or

(2)(i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above _____

(insert full name of person(s) in the offeror's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the offeror's organization);

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) above have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above.

(c) If the offeror deletes or modifies subparagraph (a)(2) above, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

(End of provision)

2 52.203-8 CANCELLATION, RESCISSION, AND RECOVERY OF FUNDS FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997)

(a) If the Government receives information that a contractor or a person has engaged in conduct constituting a violation of subsection (a), (b), (c), or (d) of Section 27 of the Office of Federal Procurement Policy Act (41 U.S.C. 423) (the Act), as amended by section 4304 of the National Defense Authorization Act for Fiscal Year 1996 (Pub. L. 104-106), the Government may--

- (1) Cancel the solicitation, if the contract has not yet been awarded or issued; or
 - (2) Rescind the contract with respect to which--
 - (i) The Contractor or someone acting for the Contractor has been convicted for an offense where the conduct constitutes a violation of subsection 27 (a) or (b) of the Act for the purpose of either--
 - (A) Exchanging the information covered by such subsections for anything of value; or
 - (B) Obtaining or giving anyone a competitive advantage in the award of a Federal agency procurement contract; or
 - (ii) The head of the contracting activity has determined, based upon a preponderance of the evidence, that the Contractor or someone acting for the Contractor has engaged in conduct constituting an offense punishable under subsection 27(e)(1) of the Act.
 - (b) If the Government rescinds the contract under paragraph (a) of this clause, the Government is entitled to recover, in addition to any penalty prescribed by law, the amount expended under the contract.
 - (c) The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law, regulation, or under this contract.
- (End of clause)

3 52.203-11 CERTIFICATION AND DISCLOSURE REGARDING PAYMENTS TO
INFLUENCE CERTAIN FEDERAL TRANSACTIONS (APR 1991)

- (a) The definitions and prohibitions contained in the clause, at FAR 52.203-12, Limitation on Payments to Influence Certain Federal Transactions, included in this solicitation, are hereby incorporated by reference in paragraph (b) of this certification.
- (b) The offeror, by signing its offer, hereby certifies to the best of his or her knowledge and belief that on or after December 23, 1989--
 - (1) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement;
 - (2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the offeror shall complete and submit, with its offer, OMB standard form LLL, Disclosure of Lobbying Activities, to the Contracting Officer; and
 - (3) He or she will include the language of this certification in all subcontract awards at any tier and require that all recipients of subcontract awards in excess of \$100,000 shall certify and disclose accordingly.
- (c) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by section 1352, title 31, United States Code. Any person who makes an expenditure prohibited under this provision or who fails to file or amend the disclosure form to

be filed or amended by this provision, shall be subject to a civil penalty of not less than \$10,000, and not more than \$100,000, for each such failure.

(End of provision)

4 52.204-3 TAXPAYER IDENTIFICATION (JUN 1997)

(a) Definitions.

"Common parent," as used in this solicitation provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

"Corporate status," as used in this solicitation provision, means a designation as to whether the offeror is a corporate entity, an unincorporated entity (e.g., sole proprietorship or partnership), or a corporation providing medical and health care services.

"Taxpayer Identification Number (TIN)," as used in this solicitation provision, means the number required by the IRS to be used by the offeror in reporting income tax and other returns.

(b) All offerors are required to submit the information required in paragraphs (c) through (e) of this solicitation provision in order to comply with reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M and implementing regulations issued by the Internal Revenue Service (IRS). If the resulting contract is subject to the reporting requirements described in FAR 4.903, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

(c) Taxpayer Identification Number (TIN).

☐ TIN: _____.

☐ TIN has been applied for.

☐ TIN is not required because:

☐ Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the U.S. and does not have an office or place of business or a fiscal paying agent in the U.S.;

☐ Offeror is an agency or instrumentality of a foreign government;

☐ Offeror is an agency or instrumentality of a Federal, state, or local government;

☐ Other. State basis. _____

(d) Corporate Status.

☐ Corporation providing medical and health care services, or engaged in the billing and collecting of payments for such services;

☐ Other corporate entity;

☐ Not a corporate entity;

☐ Sole proprietorship

☐ Partnership

☐ Hospital or extended care facility described in 26 CFR 501(c)(3) that is exempt from taxation under 26 CFR 501(a).

(e) Common Parent.

☐ Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.

☐ Name and TIN of common parent:

Name _____

TIN _____

(End of provision)

5 52.204-5 WOMEN-OWNED BUSINESS (OCT 1995)

(a) Representation. The offeror represents that it [] is, [] is not a women-owned business concern.

(b) Definition. "Women-owned business concern," as used in this provision, means a concern which is at least 51 percent owned by one or more women; or in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and whose management and daily business operations are controlled by one or more women.

(End of provision)

6 52.209-5 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS (MAR 1996)

(a)(1) The Offeror certifies, to the best of its knowledge and belief, that--

(i) The Offeror and/or any of its Principals--

(A) Are / / are not / / presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(B) Have / / have not / /, within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(C) Are / / are not / / presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in subdivision

(a)(1)(i)(B) of this provision.

(ii) The Offeror has / / has not / /, within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

THIS CERTIFICATION CONCERNS A MATTER WITHIN THE JURISDICTION OF AN AGENCY OF THE UNITED STATES AND THE MAKING OF A FALSE, FICTITIOUS, OR FRAUDULENT CERTIFICATION MAY RENDER THE MAKER SUBJECT TO PROSECUTION UNDER SECTION 1001, TITLE 18, UNITED STATES CODE.

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror

nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.

(End of provision)

7 52.209-7001 DISCLOSURE OF OWNERSHIP OR CONTROL BY THE GOVERNMENT OF A
TERRORIST COUNTRY (SEP 1994)

(a) Definitions.

As used in this provision--

(1) "Government of a terrorist country" includes the state and the government of a terrorist country, as well as any political subdivision, agency, or instrumentality thereof.

(2) "Terrorist country" means a country determined by the Secretary of State, under section 6(j)(1)(A) of the Export Administration Act of 1979 (50 U.S.C. App. 2405(j)(i)(A)), to be a country the government of which has repeatedly provided support for acts of international terrorism. As of the date of this provision, terrorist countries include: Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria.

(3) "Significant interest" means--

(i) Ownership of or beneficial interest in 5 percent or more of the firm's or subsidiary's securities. Beneficial interest includes holding 5 percent or more of any class of the firm's securities in "nominee shares," "street names," or some other method of holding securities that does not disclose the beneficial owner;

(ii) Holding a management position in the firm, such as a director or officer;

(iii) Ability to control or influence the election, appointment, or tenure of directors or officers in the firm;

(iv) Ownership of 10 percent or more of the assets of a firm such as equipment, buildings, real estate, or other tangible assets of the firm; or

(v) Holding 50 percent or more of the indebtedness of a firm.

(b) Prohibition on award.

In accordance with 10 U.S.C. 2327, no contract may be awarded to a firm or a subsidiary of a firm if the government of a terrorist country has a significant interest in the firm or subsidiary, unless a waiver is granted by the Secretary of Defense.

(c) Disclosure.

If the government of a terrorist country has a significant interest in the Offeror or a subsidiary of the Offeror, the Offeror shall disclose such interest in an attachment to its offer. If the Offeror is a subsidiary, it shall also disclose any significant interest the government of a terrorist country has in any firm that owns or controls the subsidiary. The disclosure shall include--

- (1) Identification of each government holding a significant interest;
and
- (2) A description of the significant interest held by each government.
(End of provision)

8 52.214-2 TYPE OF BUSINESS ORGANIZATION--SEALED BIDDING (JUL 1987)

The bidder, by checking the applicable box, represents that--

(a) It operates as ☐ a corporation incorporated under the laws of the State of _____, ☐ an individual, ☐ a partnership, ☐ a nonprofit organization, or ☐ a joint venture; or

(b) If the bidder is a foreign entity, it operates as ☐ an individual, ☐ a partnership, ☐ a nonprofit organization, ☐ a joint venture, or ☐ a corporation, registered for business in _____.
(country)

(End of provision)

9 52.219-1 SMALL BUSINESS PROGRAM REPRESENTATIONS (FEB 1998)

(a)(1) The standard industrial classification (SIC) code for this acquisition is 1541

(2) The small business size standard is \$17 million

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b) Representations. (1) The offeror represents as part of its offer that it ☐ is, ☐ is not a small business concern.

(2) (Complete only if offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it ☐ is, ☐ is not a small disadvantaged business concern.

(3) (Complete only if offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it ☐ is, ☐ is not a women-owned small business concern.

(c) Definitions. "Joint venture," for purposes of a small disadvantaged business (SDB) set-aside or price evaluation preference (as prescribed at 13 CFR 124.321), is a concern that is owned and controlled by one or more socially and economically disadvantaged individuals entering into a joint venture agreement with one or more business concerns and is considered to be affiliated for size purposes with such other concern(s). The combined annual receipts or employees of the concerns entering into the joint venture must meet the applicable size standard corresponding to the SIC code designated for the contract. The majority of the venture's earnings must accrue directly to the socially and economically disadvantaged individuals in the SDB concern(s) in the joint venture. The percentage of the ownership involvement in a joint venture by disadvantaged individuals must be at least 51 percent.

"Small business concern," as used in this provision, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR Part 121 and the size standard in paragraph (a) of this provision.

"Small disadvantaged business concern," as used in this provision, means

a small business concern that (1) is at least 51 percent unconditionally owned by one or more individuals who are both socially and economically disadvantaged, or a publicly owned business having at least 51 percent of its stock unconditionally owned by one or more socially and economically disadvantaged individuals, and (2) has its management and daily business controlled by one or more such individuals. This term also means a small business concern that is at least 51 percent unconditionally owned by an economically disadvantaged Indian tribe or Native Hawaiian Organization, or a publicly owned business having at least 51 percent of its stock unconditionally owned by one or more of these entities, which has its management and daily business controlled by members of an economically disadvantaged Indian tribe or Native Hawaiian Organization, and which meets the requirements of 13 CFR Part 124.

"Women-owned small business concern," as used in this provision, means a small business concern--

(1) Which is at least 51 percent owned by one or more women or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(d) Notice. (1) If this solicitation is for supplies and has been set aside, in whole or in part, for small business concerns, then the clause in this solicitation providing notice of the set-aside contains restrictions on the source of the end items to be furnished.

(2) Under 15 U.S.C. 645(d), any person who misrepresents a firm's status as a small or small disadvantaged business concern in order to obtain a contract to be awarded under the preference programs established pursuant to sections 8(a), 8(d), 9, or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall--

(i) Be punished by imposition of fine, imprisonment, or both;

(ii) Be subject to administrative remedies, including suspension and debarment; and

(iii) Be ineligible for participation in programs conducted under the authority of the Act.

(End of provision)

10 52.219-2 EQUAL LOW BIDS (OCT 1995)

(a) This provision applies to small business concerns only.

(b) The bidder's status as a labor surplus area (LSA) concern may affect entitlement to award in case of tie bids. If the bidder wishes to be considered for this priority, the bidder must identify, in the following space, the LSA in which the costs to be incurred on account of manufacturing or production (by the bidder or the first-tier subcontractors) amount to more than 50 percent of the contract price.

(c) Failure to identify the labor surplus areas as specified in paragraph (b) of this provision will preclude the bidder from receiving priority consideration. If the bidder is awarded a contract as a result of receiving priority consideration under this provision and would not have otherwise received award, the bidder shall perform the contract or cause the contract to be performed in accordance with the obligations of an LSA concern.

(End of provision)

11 52.219-19 SMALL BUSINESS CONCERN REPRESENTATION FOR THE SMALL
BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (JAN 1997)

(a) Definition.

"Emerging small business" as used in this solicitation, means a small business concern whose size is no greater than 50 percent of the numerical size standard applicable to the standard industrial classification code assigned to a contracting opportunity.

(b) (Complete only if the Offeror has represented itself under the provision at 52.219-1 as a small business concern under the size standards of this solicitation.)

The Offeror [] is, [] is not an emerging small business.

(c) (Complete only if the Offeror is a small business or an emerging small business, indicating its size range.)

Offeror's number of employees for the past 12 months (check this column if size standard stated in solicitation is expressed in terms of number of employees) or Offeror's average annual gross revenue for the last 3 fiscal years (check this column if size standard stated in solicitation is expressed in terms of annual receipts). (Check one of the following.)

No. of Employees	Avg. Annual Gross Revenues
___ 50 or fewer	___ \$1 million or less
___ 51-100	___ \$1,000,001-\$2 million
___ 101-250	___ \$2,000,001-\$3.5 million
___ 251-500	___ \$3,500,001-\$5 million
___ 501-750	___ \$5,000,001-\$10 million
___ 751-1,000	___ \$10,000,001-\$17 million
___ Over 1,000	___ Over \$17 million

(End of provision)

12 52.219-7000 SMALL DISADVANTAGED BUSINESS CONCERN REPRESENTATION (DoD
CONTRACTS) (JUN 1997)

(a) Definition. "Small disadvantaged business concern," as used in this provision, means a small business concern, owned and controlled by individuals who are both socially and economically disadvantaged, as defined by the Small Business Administration at 13 CFR Part 124, the majority of earnings of which directly accrue to such individuals. This term also means a small business concern owned and controlled by an economically disadvantaged Indian tribe or Native Hawaiian organization which meets the requirements of 13 CFR 124.112 or 13 CFR 124.113, respectively. In general, 13 CFR Part 124 describes a small disadvantaged business concern as a small business concern--

(1) Which is at least 51 percent unconditionally owned by one or more socially and economically disadvantaged individuals; or

(2) In the case of any publicly owned business, at least 51 percent of the voting stock is unconditionally owned by one or more socially and economically disadvantaged individuals; and

(3) Whose management and daily business operations are controlled by one or more such individuals.

(b) Representations. Check the category in which your ownership falls--

___ Subcontinent Asian (Asian-Indian) American (U.S. citizen with origins from India, Pakistan, Bangladesh, Sri Lanka, Bhutan, the Maldives

Islands, or Nepal)

_____ Asian-Pacific American (U.S. citizen with origins from Japan, China, the Philippines, Vietnam, Korea, Samoa, Guam, U.S. Trust Territory of the Pacific Islands (Republic of Palau), the Northern Mariana Islands, Laos, Kampuchea (Cambodia), Taiwan, Burma, Thailand, Malaysia, Indonesia, Singapore, Brunei, Republic of the Marshall Islands, the Federated States of Micronesia, Macao, Hong Kong, Fiji, Tonga, Kiribati, Tuvalu, or Nauru)

_____ Black American (U.S. citizen)

_____ Hispanic American (U.S. citizen with origins from South America, Central America, Mexico, Cuba, the Dominican Republic, Puerto Rico, Spain, or Portugal)

_____ Native American (American Indians, Eskimos, Aleuts, or Native Hawaiians, including Indian tribes or Native Hawaiian organizations)

_____ Individual/concern, other than one of the preceding, currently certified for participation in the Minority Small Business and Capital Ownership Development Program under Section 8(a) of the Small Business Act

_____ Other

(c) Complete the following--

(1) The offeror is _____ is not _____ a small disadvantaged business concern.

(2) The Small Business Administration (SBA) has _____ has not _____ made a determination concerning the offeror's status as a small disadvantaged business concern. If the SBA has made a determination, the date of the determination was _____ and the offeror--

_____ Was found by SBA to be socially and economically disadvantaged and no circumstances have changed to vary that determination.

_____ Was found by SBA not to be socially and economically disadvantaged but circumstances which caused the determination have changed.

(d) Penalties and Remedies. Anyone who misrepresents the status of a concern as a small disadvantaged business for the purpose of securing a contract or subcontract shall--

(1) Be punished by imposition of a fine, imprisonment, or both;

(2) Be subject to administrative remedies, including suspension and debarment; and

(3) Be ineligible for participation in programs conducted under authority of the Small Business Act.

(End of provision)

AM #1 13 52.222-22 PREVIOUS CONTRACTS AND COMPLIANCE REPORTS (APR 1984)
(DEVIATION)

The offeror represents that--

(a) It /_/ has, /_/ has not, participated in a previous contract or subcontract subject to the Equal Opportunity clause of this solicitation.

(b) It /_/ has, /_/ has not filed all required compliance reports; and

(c) Representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained before subcontract awards.

(End of provision)

14 52.223-1 CLEAN AIR AND WATER CERTIFICATION (APR 1984)

The Offeror certifies that--

(a) Any facility to be used in the performance of this proposed contract is ☐ is not ☐ listed on the Environmental Protection Agency (EPA) List of Violating Facilities;

(b) The Offeror will immediately notify the Contracting Officer, before award, of the receipt of any communication from the Administrator, or a designee, of the EPA, indicating that any facility that the Offeror proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities; and

(c) The Offeror will include a certification substantially the same as this certification, including this paragraph (c), in every nonexempt subcontract.

(End of provision)
(AV 7-2003.71 1977 JUN)
(AV 1-1.2302-1)

15 52.223-13 CERTIFICATION OF TOXIC CHEMICAL RELEASE REPORTING (OCT 1996)

(a) Submission of this certification is a prerequisite for making or entering into this contract imposed by Executive Order 12969, August 8, 1995.

(b) By signing this offer, the offeror certifies that----

(1) As the owner or operator of facilities that will be used in the performance of this contract that are subject to the filing and reporting requirements described in section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023) and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106), the offeror will file and continue to file for such facilities for the life of the contract the Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of EPCRA and section 6607 of PPA; or

(2) None of its owned or operated facilities to be used in the performance of this contract is subject to the Form R filing and reporting requirements because each such facility is exempt for at least one of the following reasons: (Check each block that is applicable.)

☐ (i) The facility does not manufacture, process, or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

☐ (ii) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);

☐ (iii) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

☐ (iv) The facility does not fall within Standard Industrial Classification Code (SIC) designations 20 through 39 as set forth in Section 19.102 of the Federal Acquisition Regulation; or

☐ (v) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over

which the United States has jurisdiction.
(End of provision)

16 52.247-7022 REPRESENTATION OF EXTENT OF TRANSPORTATION BY SEA (AUG
1992)

(a) The Offeror shall indicate by checking the appropriate blank in paragraph (b) of this provision whether transportation of supplies by sea is anticipated under the resultant contract. The term "supplies" is defined in the Transportation of Supplies by Sea clause of this solicitation.

(b) Representation. The Offeror represents that it--
_____ Does anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.
_____ Does not anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

(c) Any contract resulting from this solicitation will include the Transportation of Supplies by Sea clause. If the Offeror represents that it will not use ocean transportation, the resulting contract will also include the Defense FAR Supplement clause at 252.247-7024, Notification of Transportation of Supplies by Sea.

(End of provision)

END OF SECTION 00600

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(DEVIATION) (DEVIATION)

SECTION 00700

CONTRACT CLAUSES

1 52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at these addresses: full text of a clause may be accessed electronically at these addresses:

2 52.0-4000 CONTRACT CLAUSE AND SOLICITATION PROVISION NUMBERING (FEB 1996) (LOCAL) (52.0000-4000)

This document is computer generated by the Standard Army Automated Contracting System (SAACONS). The numbering system used by the computer for contract clauses and solicitation provisions differs slightly from the procurement regulations. It is similar and easily recognizable. The Federal Acquisition Regulation (FAR) numbering format for contract clauses and solicitation provisions is 52.2xx-x, with the specific FAR provision or clause number being a sequence assigned within each section or subpart 52.2. SAACONS always uses a 9 digit number (e.g. 52.2XX.XXXX). FAR contract clauses and solicitation provisions are recognized by a "0" in the 6th digit of the SAACONS number. Department of Defense Federal Acquisition Regulation Supplement (DFARS) contract clauses and solicitation provisions are recognized by a "7" in the 6th digit of the SAACONS number. Army Federal Acquisition Regulation Supplement (AFARS) contract clauses and solicitation provisions are recognized by a "9" in the 6th digit of the SAACONS number. Engineer Federal Acquisition Regulation Supplement (EFARS) contract clauses and solicitation provisions are recognized by a "5" in the 6th digit of the SAACONS number. Local instructions and provisions which were previously referred to by paragraph number only, now appear as "local clauses" with local clause numbers. They are recognizable by a "4" in the 6th digit of the SAACONS number. FAR, DFARS, AFARS, and EFARS clauses and provisions that have recently been modified or added may also be numbered as local clauses pending their integration into the SAACONS database. Until the integration is complete the title line will identify the regulatory source. Examples of the difference in the numbering are provided below:

STANDARD NUMBERING SYSTEM		SAACONS
FAR	52.227-1	52.227-0001
DFARS	252.243-7000	52.243-7000
AFARS	52.237-9030	52.237-9030
EFARS	52.202-10001	52.202.5001
LOCAL	NONE	52.XXX.4XXX

Authorized alternate versions of the clauses are sometimes used, and are identified in the applicable regulation by sequential Roman numeral identifiers. When an alternate version is used the SAACONS clause number will be followed by the appropriate Roman numeral identified. For example, FAR Clause 52.202-1 in its Alternate I version is entitled "DEFINITIONS (APR 1984)--ALTERNATE I (APR 1984)". The clause number will appear as "52.202-1 I". An Alternate II version of a clause would appear as "52.xxx-xxxx II".

3 52.201-7000 CONTRACTING OFFICER'S REPRESENTATIVE (DEC 1991)

(a) Definition. "Contracting officer's representative" means an individual designated in accordance with subsection 201.602-2 of the Defense Federal Acquisition Regulation Supplement and authorized in writing by the Contracting Officer to perform specific technical or administrative functions.

(b) If the Contracting Officer designates a contracting officer's representative (COR), the Contractor will receive a copy of the written designation. It will specify the extent of the COR's authority to act on behalf of the Contracting Officer. The COR is not authorized to make any commitments or changes that will affect price, quality, quantity, delivery, or any other term or condition of the contract.

(End of clause)

4 52.202-1 I DEFINITIONS (OCT 1995)--ALTERNATE I (APR 1984)

(a) "Head of the agency" (also called "agency head") or "Secretary" means the Secretary (or Attorney General, Administrator, Governor, Chairperson, or other chief official, as appropriate) of the agency, including any deputy or assistant chief official of the agency; and the term "authorized representative" means any person, persons, or board (other than the Contracting Officer) authorized to act for the head of the agency or Secretary.

(b) Commercial component means any component that is a commercial item.

(c) Component means any item supplied to the Federal Government as part of an end item or of another component.

(d) Nondevelopmental item means--

(1) Any previously developed item of supply used exclusively for governmental purposes by a Federal agency, a State or local government, or a foreign government with which the United States has a mutual defense cooperation agreement;

(2) Any item described in paragraph (e)(1) of this definition that requires only minor modification or modifications of a type customarily available in the commercial marketplace in order to meet the requirements of the procuring department or agency; or

(3) Any item of supply being produced that does not meet the requirements of paragraph (e)(1) or (e)(2) solely because the item is not yet in use.

(e) "Contracting Officer" means a person with the authority to enter into, administer, and/or terminate contracts and make related determinations and findings. The term includes certain authorized representatives of the Contracting Officer acting within the limits of their authority as delegated by the Contracting Officer.

(f) Except as otherwise provided in this contract, the term "subcontracts" includes, but is not limited to, purchase orders and changes and modifications to purchase orders under this contract.

(End of clause)

5 52.203-3 GRATUITIES (APR 1984)

(a) The right of the Contractor to proceed may be terminated by written notice if, after notice and hearing, the agency head or a designee determines that the Contractor, its agent, or another representative--

(1) Offered or gave a gratuity (e.g., an entertainment or gift) to an

officer, official, or employee of the Government; and

(2) Intended, by the gratuity, to obtain a contract or favorable treatment under a contract.

(b) The facts supporting this determination may be reviewed by any court having lawful jurisdiction.

(c) If this contract is terminated under paragraph (a) above, the Government is entitled--

(1) To pursue the same remedies as in a breach of the contract; and

(2) In addition to any other damages provided by law, to exemplary damages of not less than 3 nor more than 10 times the cost incurred by the Contractor in giving gratuities to the person concerned, as determined by the agency head or a designee. (This subparagraph (c)(2) is applicable only if this contract uses money appropriated to the Department of Defense.)

(d) The rights and remedies of the Government provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

(R 7-104.16 1952 MAR)

6 52.203-5 COVENANT AGAINST CONTINGENT FEES (APR 1984)

(a) The Contractor warrants that no person or agency has been employed or retained to solicit or obtain this contract upon an agreement or understanding for a contingent fee, except a bona fide employee or agency. For breach or violation of this warranty, the Government shall have the right to annul this contract without liability or, in its discretion, to deduct from the contract price or consideration, or otherwise recover, the full amount of the contingent fee.

(b) "Bona fide agency," as used in this clause, means an established commercial or selling agency, maintained by a contractor for the purpose of securing business, that neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds itself out as being able to obtain any Government contract or contracts through improper influence.

"Bona fide employee," as used in this clause, means a person, employed by a Contractor and subject to the Contractor's supervision and control as to time, place, and manner of performance, who neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds out as being able to obtain any Government contract or contracts through improper influence.

"Contingent fee," as used in this clause, means any commission, percentage, brokerage, or other fee that is contingent upon the success that a person or concern has in securing a Government contract.

"Improper influence," as used in this clause, means any influence that induces or tends to induce a Government employee or officer to give consideration or to act regarding a Government contract on any basis other than the merits of the matter.

(End of clause)

(R 7-103.20 1958 JAN)

(R 1-1.503)

(R 1-7.102-18)

7 52.203-7 ANTI-KICKBACK PROCEDURES (JUL 1995)

(a) Definitions.

"Kickback," as used in this clause, means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided, directly or indirectly, to any prime Contractor, prime Contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a subcontract relating to a prime contract.

"Person," as used in this clause, means a corporation, partnership, business association of any kind, trust, joint-stock company, or individual.

"Prime contract," as used in this clause, means a contract or contractual action entered into by the United States for the purpose of obtaining supplies, materials, equipment, or services of any kind.

"Prime Contractor" as used in this clause, means a person who has entered into a prime contract with the United States.

"Prime Contractor employee," as used in this clause, means any officer, partner, employee, or agent of a prime Contractor.

"Subcontract," as used in this clause, means a contract or contractual action entered into by a prime Contractor or subcontractor for the purpose of obtaining supplies, materials, equipment, or services of any kind under a prime contract.

"Subcontractor," as used in this clause, (1) means any person, other than the prime Contractor, who offers to furnish or furnishes any supplies, materials, equipment, or services of any kind under a prime contract or a subcontract entered into in connection with such prime contract, and (2) includes any person who offers to furnish or furnishes general supplies to the prime Contractor or a higher tier subcontractor.

"Subcontractor employee," as used in this clause, means any officer, partner, employee, or agent of a subcontractor.

(b) The Anti-Kickback Act of 1986 (41 U.S.C. 51-58) (the Act), prohibits any person from--

(1) Providing or attempting to provide or offering to provide any kickback;

(2) Soliciting, accepting, or attempting to accept any kickback; or

(3) Including, directly or indirectly, the amount of any kickback in the contract price charged by a prime Contractor to the United States or in the contract price charged by a subcontractor to a prime Contractor or higher tier subcontractor.

(c)(1) The Contractor shall have in place and follow reasonable procedures designed to prevent and detect possible violations described in paragraph (b) of this clause in its own operations and direct business relationships.

(2) When the Contractor has reasonable grounds to believe that a violation described in paragraph (b) of this clause may have occurred, the Contractor shall promptly report in writing the possible violation. Such reports shall be made to the inspector general of the contracting agency, the head of the contracting agency if the agency does not have an inspector general, or the Department of Justice.

(3) The Contractor shall cooperate fully with any Federal agency investigating a possible violation described in paragraph (b) of this clause.

(4) The Contracting Officer may (i) offset the amount of the kickback against any monies owed by the United States under the prime contract and/or (ii) direct that the Prime Contractor withhold from sums owed a

subcontractor under the prime contract the amount of the kickback. The Contracting Officer may order that monies withheld under subdivision (c)(4)(ii) of this clause be paid over to the Government unless the Government has already offset those monies under subdivision (c)(4)(i) of this clause. In either case, the Prime Contractor shall notify the Contracting Officer when the monies are withheld.

(5) The Contractor agrees to incorporate the substance of this clause, including subparagraph (c)(5) but excepting subparagraph (c)(1), in all subcontracts under this contract which exceed \$100,000.

(End of clause)

8 52.203-10 PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY
(JAN 1997)

(a) The Government, at its election, may reduce the price of a fixed-price type contract and the total cost and fee under a cost-type contract by the amount of profit or fee determined as set forth in paragraph (b) of this clause if the head of the contracting activity or designee determines that there was a violation of subsection 27 (a), (b), or (c) of the Office of Federal Procurement Policy Act, as amended (41 U.S.C. 423), as implemented in section 3.104 of the Federal Acquisition Regulation.

(b) The price or fee reduction referred to in paragraph (a) of this clause shall be--

(1) For cost-plus-fixed-fee contracts, the amount of the fee specified in the contract at the time of award;

(2) For cost-plus-incentive-fee contracts, the target fee specified in the contract at the time of award, notwithstanding any minimum fee or "fee floor" specified in the contract;

(3) For cost-plus-award-fee contracts--

(i) The base fee established in the contract at the time of contract award;

(ii) If no base fee is specified in the contract, 30 percent of the amount of each award fee otherwise payable to the Contractor for each award fee evaluation period or at each award fee determination point.

(4) For fixed-price-incentive contracts, the Government may--

(i) Reduce the contract target price and contract target profit both by an amount equal to the initial target profit specified in the contract at the time of contract award; or

(ii) If an immediate adjustment to the contract target price and contract target profit would have a significant adverse impact on the incentive price revision relationship under the contract, or adversely affect the contract financing provisions, the Contracting Officer may defer such adjustment until establishment of the total final price of the contract. The total final price established in accordance with the incentive price revision provisions of the contract shall be reduced by an amount equal to the initial target profit specified in the contract at the time of contract award and such reduced price shall be the total final contract price.

(5) For firm-fixed-price contracts, by 10 percent of the initial contract price or a profit amount determined by the Contracting Officer from records or documents in existence prior to the date of the contract award.

(c) The Government may, at its election, reduce a prime contractor's price or fee in accordance with the procedures of paragraph (b) of this clause for violations of the Act by its subcontractors by an amount not to

exceed the amount of profit or fee reflected in the subcontract at the time the subcontract was first definitively priced.

(d) In addition to the remedies in paragraphs (a) and (c) of this clause, the Government may terminate this contract for default. The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

9 52.203-12 LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL
TRANSACTIONS (JUN1997)

(a) Definitions.

"Agency," as used in this clause, means executive agency as defined in 2.101.

"Covered Federal action," as used in this clause, means any of the following Federal actions:

- (1) The awarding of any Federal contract.
- (2) The making of any Federal grant.
- (3) The making of any Federal loan.
- (4) The entering into of any cooperative agreement.
- (5) The extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

"Indian tribe" and "tribal organization," as used in this clause, have the meaning provided in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450B) and include Alaskan Natives.

"Influencing or attempting to influence," as used in this clause, means making, with the intent to influence, any communication to or appearance before an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any covered Federal action.

"Local government," as used in this clause, means a unit of government in a State and, if chartered, established, or otherwise recognized by a State for the performance of a governmental duty, including a local public authority, a special district, an intrastate district, a council of governments, a sponsor group representative organization, and any other instrumentality of a local government.

"Officer or employee of an agency," as used in this clause, includes the following individuals who are employed by an agency:

- (1) An individual who is appointed to a position in the Government under title 5, United States Code, including a position under a temporary appointment.
- (2) A member of the uniformed services, as defined in subsection 101(3), title 37, United States Code.
- (3) A special Government employee, as defined in section 202, title 18, United States Code.
- (4) An individual who is a member of a Federal advisory committee, as defined by the Federal Advisory Committee Act, title 5, United States Code, appendix 2.

"Person," as used in this clause, means an individual, corporation, company, association, authority, firm, partnership, society, State, and local government, regardless of whether such entity is operated for profit, or not for profit. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Reasonable compensation," as used in this clause, means, with respect

to a regularly employed officer or employee of any person, compensation that is consistent with the normal compensation for such officer or employee for work that is not furnished to, not funded by, or not furnished in cooperation with the Federal Government.

"Reasonable payment," as used in this clause, means, with respect to professional and other technical services, a payment in an amount that is consistent with the amount normally paid for such services in the private sector.

"Recipient," as used in this clause, includes the Contractor and all subcontractors. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Regularly employed," as used in this clause, means, with respect to an officer or employee of a person requesting or receiving a Federal contract, an officer or employee who is employed by such person for at least 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person for receipt of such contract. An officer or employee who is employed by such person for less than 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person shall be considered to be regularly employed as soon as he or she is employed by such person for 130 working days.

"State," as used in this clause, means a State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, a territory or possession of the United States, an agency or instrumentality of a State, and multi-State, regional, or interstate entity having governmental duties and powers.

(b) Prohibitions.

(1) Section 1352 of title 31, United States Code, among other things, prohibits a recipient of a Federal contract, grant, loan, or cooperative agreement from using appropriated funds to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; or the modification of any Federal contract, grant, loan, or cooperative agreement.

(2) The Act also requires Contractors to furnish a disclosure if any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a Federal contract, grant, loan, or cooperative agreement.

(3) The prohibitions of the Act do not apply under the following conditions:

(i) Agency and legislative liaison by own employees.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of a payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action if the payment is for agency and legislative liaison activities not directly related to a covered Federal action.

(B) For purposes of subdivision (b)(3)(i)(A) of this clause, providing any information specifically requested by an agency or Congress is permitted at any time.

(C) The following agency and legislative liaison activities are permitted at any time where they are not related to a specific solicitation for any covered Federal action:

(1) Discussing with an agency the qualities and characteristics (including individual demonstrations) of the person's products or services, conditions or terms of sale, and service capabilities.

(2) Technical discussions and other activities regarding the application or adaptation of the person's products or services for an agency's use.

(D) The following agency and legislative liaison activities are permitted where they are prior to formal solicitation of any covered Federal action--

(1) Providing any information not specifically requested but necessary for an agency to make an informed decision about initiation of a covered Federal action;

(2) Technical discussions regarding the preparation of an unsolicited proposal prior to its official submission; and

(3) Capability presentations by persons seeking awards from an agency pursuant to the provisions of the Small Business Act, as amended by Pub. L. 95-507, and subsequent amendments.

(E) Only those services expressly authorized by subdivision (b)(3)(i)(A) of this clause are permitted under this clause.

(ii) Professional and technical services.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of--

(1) A payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action, if payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action.

(2) Any reasonable payment to a person, other than an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action if the payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action. Persons other than officers or employees of a person requesting or receiving a covered Federal action include consultants and trade associations.

(B) For purposes of subdivision (b)(3)(ii)(A) of this clause, "professional and technical services" shall be limited to advice and analysis directly applying any professional or technical discipline. For example, drafting of a legal document accompanying a bid or proposal by a lawyer is allowable. Similarly, technical advice provided by an engineer on the performance or operational capability of a piece of equipment rendered directly in the negotiation of a contract is allowable. However, communications with the intent to influence made by a professional (such as a licensed lawyer) or a technical person (such as a licensed accountant) are not allowable under this section unless they provide advice and analysis directly applying their professional or technical expertise and unless the advice or analysis

is rendered directly and solely in the preparation, submission or negotiation of a covered Federal action. Thus, for example, communications with the intent to influence made by a lawyer that do not provide legal advice or analysis directly and solely related to the legal aspects of his or her client's proposal, but generally advocate one proposal over another are not allowable under this section because the lawyer is not providing professional legal services. Similarly, communications with the intent to influence made by an engineer providing an engineering analysis prior to the preparation or submission of a bid or proposal are not allowable under this section since the engineer is providing technical services but not directly in the preparation, submission or negotiation of a covered Federal action.

(C) Requirements imposed by or pursuant to law as a condition for receiving a covered Federal award include those required by law or regulation and any other requirements in the actual award documents.

(D) Only those services expressly authorized by subdivisions (b)(3)(ii)(A)(1) and (2) of this clause are permitted under this clause.

(E) The reporting requirements of FAR 3.803(a) shall not apply with respect to payments of reasonable compensation made to regularly employed officers or employees of a person.

(c) Disclosure.

(1) The Contractor who requests or receives from an agency a Federal contract shall file with that agency a disclosure form, OMB standard form LLL, Disclosure of Lobbying Activities, if such person has made or has agreed to make any payment using nonappropriated funds (to include profits from any covered Federal action), which would be prohibited under subparagraph (b)(1) of this clause, if paid for with appropriated funds.

(2) The Contractor shall file a disclosure form at the end of each calendar quarter in which there occurs any event that materially affects the accuracy of the information contained in any disclosure form previously filed by such person under subparagraph (c)(1) of this clause. An event that materially affects the accuracy of the information reported includes--

(i) A cumulative increase of \$25,000 or more in the amount paid or expected to be paid for influencing or attempting to influence a covered Federal action; or

(ii) A change in the person(s) or individual(s) influencing or attempting to influence a covered Federal action; or

(iii) A change in the officer(s), employee(s), or Member(s) contacted to influence or attempt to influence a covered Federal action.

(3) The Contractor shall require the submittal of a certification, and if required, a disclosure form by any person who requests or receives any subcontract exceeding \$100,000 under the Federal contract.

(4) All subcontractor disclosure forms (but not certifications) shall be forwarded from tier to tier until received by the prime Contractor. The prime Contractor shall submit all disclosures to the Contracting Officer at the end of the calendar quarter in which the disclosure form is submitted by the subcontractor. Each subcontractor certification shall be retained in the subcontract file of the awarding Contractor.

(d) Agreement. The Contractor agrees not to make any payment prohibited by this clause.

(e) Penalties.

(1) Any person who makes an expenditure prohibited under paragraph (a) of this clause or who fails to file or amend the disclosure form to

be filed or amended by paragraph (b) of this clause shall be subject to civil penalties as provided for by 31 U.S.C. 1352. An imposition of a civil penalty does not prevent the Government from seeking any other remedy that may be applicable.

(2) Contractors may rely without liability on the representation made by their subcontractors in the certification and disclosure form.

(f) Cost allowability. Nothing in this clause makes allowable or reasonable any costs which would otherwise be unallowable or unreasonable. Conversely, costs made specifically unallowable by the requirements in this clause will not be made allowable under any other provision.

(End of clause)

10 52.203-7001 SPECIAL PROHIBITION ON EMPLOYMENT (JUN 1997)

(a) Definitions.

As used in this clause--

(1) "Arising out of a contract with the DoD" means any act in connection with--

(i) Attempting to obtain,

(ii) Obtaining, or

(iii) Performing a contract or first-tier subcontract of any agency, department, or component of the Department of Defense (DoD).

(2) "Conviction of fraud or any other felony" means any conviction for fraud or a felony in violation of state or Federal criminal statutes, whether entered on a verdict or plea, including a plea of nolo contendere, for which sentence has been imposed.

(3) "Date of conviction" means the date judgment was entered against the individual.

(b) 10 U.S.C. 2408 provides that any individual who is convicted after September 29, 1988, of fraud or any other felony arising out of a contract with the DoD is prohibited from:

(1) Working in a management or supervisory capacity on any DoD contract or first-tier subcontract;

(2) Serving on the board of directors of any DoD Contractor or first-tier subcontractor; or

(3) Serving as a consultant to any DoD Contractor or first-tier subcontractor.

(c) Unless waived, the prohibition in paragraph (b) applies for five years from the date of conviction.

(d) 10 U.S.C. 2408 further provides that a defense Contractor or first-tier subcontractor shall be subject to a criminal penalty of not more than \$500,000 if convicted of knowingly--

(1) Employing a person under a prohibition specified in paragraph (b) of this clause; or

(2) Allowing such a person to serve on the board of directors of the Contractor or first-tier subcontractor.

(e) In addition to the criminal penalties contained in 10 U.S.C. 2408, the Government may consider other available remedies, such as--

(1) Suspension or debarment;

(2) Cancellation of the contract at no cost to the Government; or

(3) Termination of the contract for default.

(f) The Contractor may submit written requests for waiver of the prohibitions in paragraph (b) of this clause to the Contracting Officer. Requests shall clearly identify--

(1) The person involved;

(2) The nature of the conviction and resultant sentence or punishment imposed;

(3) The reasons for the requested waiver; and,

(4) An explanation of why a waiver is in the interest of national security.

(g) The Contractor agrees to include the substance of this clause, appropriately modified to reflect the identity and relationship of the parties, in all first-tier subcontracts exceeding the simplified acquisition threshold in Part 2 of the Federal Acquisition Regulation, except those for commercial items or components.

(h) Pursuant to 10 U.S.C. 2408(c), defense contractors and subcontractors may obtain information as to whether a particular person has been convicted of fraud or any other felony arising out of a contract with the DoD by contacting The Office of Justice Programs, The Denial of Benefits Office, U.S. Department of Justice, telephone (202) 616-3507.

(End of clause)

11 52.203-7002 DISPLAY OF DOD HOTLINE POSTER (DEC 1991)

(a) The Contractor shall display prominently in common work areas within business segments performing work under Department of Defense (DoD) contracts, DoD Hotline Posters prepared by the DoD Office of the Inspector General.

(b) DoD Hotline Posters may be obtained from the DoD Inspector General, ATTN: Defense Hotline, 400 Army Navy Drive, Washington, DC 22202-2884.

(c) The Contractor need not comply with paragraph (a) of this clause if it has established a mechanism, such as a hotline, by which employees may report suspected instances of improper conduct, and instructions that encourage employees to make such reports.

(End of clause)

12 52.204-4 PRINTING/COPYING DOUBLE-SIDED ON RECYCLED PAPER (JUN 1996)

(a) In accordance with Executive Order 12873, dated October 20, 1993, as amended by Executive Order 12995, dated March 25, 1996, the Offeror/Contractor is encouraged to submit paper documents, such as offers, letters, or reports, that are printed/copied double-sided on recycled paper that has at least 20 percent postconsumer material.

(b) The 20 percent standard applies to high-speed copier paper, offset paper, forms bond, computer printout paper, carbonless paper, file folders, white woven envelopes, and other uncoated printed and writing paper, such as writing and office paper, book paper, cotton fiber paper, and cover stock. An alternative to meeting the 20 percent postconsumer material standard is 50 percent recovered material content of certain industrial by-products.

(End of clause)

13 52.204-7003 CONTROL OF GOVERNMENT PERSONNEL WORK PRODUCT (APR 1992)

The Contractor's procedures for protecting against unauthorized disclosure of information shall not require Department of Defense employees or members of the Armed Forces to relinquish control of their work products, whether classified or not, to the Contractor.

(End of clause)

14 52.205-7000 PROVISION OF INFORMATION TO COOPERATIVE AGREEMENT HOLDERS
(DEC 1991)

(a) Definition.

"Cooperative agreement holder" means a State or local government; a private, nonprofit organization; a tribal organization (as defined in section 4(c) of the Indian Self-Determination and Education Assistance Act (Pub. L. 93-268; 25 U.S.C. 450(c))); or an economic enterprise (as defined in section 3(e) of the Indian Financing Act of 1974 (Pub. L. 93-362; 25 U.S.C. 1452(e))) whether such economic enterprise is organized for profit or nonprofit purposes; which has an agreement with the Defense Logistics Agency to furnish procurement technical assistance to business entities.

(b) The Contractor shall provide cooperative agreement holders, upon their request, with a list of those appropriate employees or offices responsible for entering into subcontracts under defense contracts. The list shall include the business address, telephone number, and area of responsibility of each employee or office.

(c) The Contractor need not provide the listing to a particular cooperative agreement holder more frequently than once a year.

(End of clause)

15 52.209-6 PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING
WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR
DEBARMENT (JUL 1995)

(a) The Government suspends or debar Contractors to protect the Government's interest. The Contractor shall not enter into any subcontract in excess of \$25,000 with a Contractor that is debarred, suspended, or proposed for debarment unless there is a compelling reason to do so.

(b) The Contractor shall require each proposed first-tier subcontractor, whose subcontract will exceed \$25,000, to disclose to the Contractor, in writing, whether as of the time of award of the subcontract, the subcontractor, or its principals, is or is not debarred, suspended, or proposed for debarment by the Federal Government.

(c) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is debarred, suspended, or proposed for debarment (see FAR 9.404 for information on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs). The notice must include the following:

(1) The name of the subcontractor.

(2) The Contractor's knowledge of the reasons for the subcontractor being on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

(3) The compelling reason(s) for doing business with the subcontractor notwithstanding its inclusion on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

(4) The systems and procedures the Contractor has established to ensure that it is fully protecting the Government's interests when dealing with such subcontractor in view of the specific basis for the party's debarment, suspension, or proposed debarment.

(End of clause)

16 52.209-7000 ACQUISITION FROM SUBCONTRACTORS SUBJECT TO ON-SITE
INSPECTION UNDER THE INTERMEDIATE-RANGE NUCLEAR FORCES
(INF) TREATY (NOV 1995)

(a) The Contractor shall not deny consideration for a subcontract award under this contract to a potential subcontractor subject to on-site inspection under the INF Treaty, or a similar treaty, solely or in part because of the actual or potential presence of Soviet inspectors at the subcontractor's facility, unless the decision is approved by the Contracting Officer.

(b) The Contractor shall incorporate this clause, including this paragraph (b), in all solicitations and contracts exceeding the simplified acquisition threshold in Part 13 of the Federal Acquisition Regulation, except those for commercial items.

(End of clause)

17 52.211-18 VARIATION IN ESTIMATED QUANTITY (APR 1984)

If the quantity of a unit-priced item in this contract is an estimated quantity and the actual quantity of the unit-priced item varies more than 15 percent above or below the estimated quantity, an equitable adjustment in the contract price shall be made upon demand of either party. The equitable adjustment shall be based upon any increase or decrease in costs due solely to the variation above 115 percent or below 85 percent of the estimated quantity. If the quantity variation is such as to cause an increase in the time necessary for completion, the Contractor may request, in writing, an extension of time, to be received by the Contracting Officer within 10 days from the beginning of the delay, or within such further period as may be granted by the Contracting Officer before the date of final settlement of the contract. Upon the receipt of a written request for an extension, the Contracting Officer shall ascertain the facts and make an adjustment for extending the completion date as, in the judgement of the Contracting Officer, is justified.

(End of clause)

18 52.214-26 AUDIT AND RECORDS--SEALED BIDDING (OCT 1997)

(a) As used in this clause, records includes books, documents, accounting procedures and practices, and other data, regardless of type and regardless of whether such items are in written form, in the form of computer data, or in any other form.

(b) Cost or pricing data. If the Contractor has been required to submit cost or pricing data in connection with the pricing of any modification to this contract, the Contracting Officer, or an authorized representative of the Contracting Officer, in order to evaluate the accuracy, completeness, and currency of the cost or pricing data, shall have the right to examine and audit all of the Contractor's records, including computations and projections, related to--

- (1) The proposal for the modification;
- (2) The discussions conducted on the proposal(s), including those related to negotiating;
- (3) Pricing of the modification; or
- (4) Performance of the modification.

(c) Comptroller General. In the case of pricing any modification, the Comptroller General of the United States, or an authorized representative,

shall have the same rights as specified in paragraph (b) of this clause.

(d) Availability. The Contractor shall make available at its office at all reasonable times the materials described in reproduction, until 3 years after final payment under this contract, or for any other period specified in Subpart 4.7 of the Federal Acquisition Regulation (FAR). FAR Subpart 4.7, Contractor Records Retention, in effect on the date of this contract, is incorporated by reference in its entirety and made a part of this contract.

(1) If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for 3 years after any resulting final termination settlement.

(2) Records pertaining to appeals under the Disputes clause or to litigation or the settlement of claims arising under or relating to the performance of this contract shall be made available until disposition of such appeals, litigation, or claims.

(e) The Contractor shall insert a clause containing all the provisions of this clause, including this paragraph (e), in all subcontracts expected to exceed the threshold in FAR 15.403-4(a)(1) for submission of cost or pricing data.

(End of clause)

19 52.214-27 PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA--
MODIFICATIONS--SEALED BIDDING (OCT 1997)

(a) This clause shall become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for the submission of cost or pricing data at FAR 15.403-4(a)(1), except that this clause does not apply to a modification if an exception under FAR 15.403-1(b) applies.

(b) If any price, including profit, negotiated in connection with any modification under this clause, was increased by any significant amount because (1) the Contractor or a subcontractor furnished cost or pricing data that were not complete, accurate, and current as certified in its Certificate of Current Cost or Pricing Data, (2) a subcontractor or prospective subcontractor furnished the Contractor cost or pricing data that were not complete, accurate, and current as certified in the Contractor's Certificate of Current Cost or Pricing Data, or (3) any of these parties furnished data of any description that were not accurate, the price shall be reduced accordingly and the contract shall be modified to reflect the reduction. This right to a price reduction is limited to that resulting from defects in data relating to modifications for which this clause becomes operative under paragraph (a) above.

(c) Any reduction in the contract price under paragraph (b) above due to defective data from a prospective subcontractor that was not subsequently awarded the subcontract shall be limited to the amount, plus applicable overhead and profit markup, by which (1) the actual subcontract or (2) the actual cost to the Contractor, if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; provided, that the actual subcontract price was not itself affected by defective cost or pricing data.

(d)(1) If the Contracting Officer determines under paragraph (b) of this clause that a price or cost reduction should be made, the Contractor agrees not to raise the following matters as a defense:

(i) The Contractor or subcontractor was a sole source supplier or otherwise was in a superior bargaining position and thus the price of the contract would not have been modified even if accurate, complete,

and current cost or pricing data had been submitted.

(ii) The Contracting Officer should have known that the cost or pricing data in issue were defective even though the Contractor or subcontractor took no affirmative action to bring the character of the data to the attention of the Contracting Officer.

(iii) The contract was based on an agreement about the total cost of the contract and there was no agreement about the cost of each item procured under the contract.

(iv) The Contractor or subcontractor did not submit a Certificate of Current Cost or Pricing Data.

(2)(i) Except as prohibited by subdivision (d)(2)(ii) of this clause, an offset in an amount determined appropriate by the Contracting Officer based upon the facts shall be allowed against the amount of a contract price reduction if--

(A) The Contractor certifies to the Contracting Officer that, to the best of the Contractor's knowledge and belief, the Contractor is entitled to the offset in the amount requested; and

(B) The Contractor proves that the cost or pricing data were available before the date of agreement on the price of the contract (or price of the modification) and that the data were not submitted before such date.

(ii) An offset shall not be allowed if--

(A) The understated data was known by the Contractor to be understated when the Certificate of Current Cost or Pricing Data was signed; or

(B) The Government proves that the facts demonstrate that the contract price would not have increased in the amount to be offset even if the available data had been submitted before the date of agreement on price.

(e) If any reduction in the contract price under this clause reduces the price of items for which payment was made prior to the date of the modification reflecting the price reduction, the Contractor shall be liable to and shall pay the United States at the time such overpayment is repaid--

(1) Simple interest on the amount of such overpayment to be computed from the date(s) of overpayment to the Contractor to the date the Government is repaid by the Contractor at the applicable underpayment rate effective for each quarter prescribed by the Secretary of the Treasury under 26 U.S.C. 6621(a)(2); and

(2) A penalty equal to the amount of the overpayment, if the Contractor or subcontractor knowingly submitted cost or pricing data which were incomplete, inaccurate, or noncurrent.

(End of clause)

20 52.214-28 SUBCONTRACTOR COST OR PRICING DATA--MODIFICATIONS--SEALED
BIDDING (OCT 1997)

(a) The requirements of paragraphs (b) and (c) of this clause shall (1) become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), and (2) be limited to such modifications.

(b) Before awarding any subcontract expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), on the date of agreement on price or the date of award, whichever is later; or before pricing any subcontract modifications involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the

threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), the Contractor shall require the subcontractor to submit cost or pricing data (actually or by specific identification in writing), unless an exception under FAR 15.403-1(b) applies.

(c) The Contractor shall require the subcontractor to certify in substantially the form prescribed in subsection FAR 15.406-2 that, to the best of its knowledge and belief, the data submitted under paragraph (b) of this clause were accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract modification.

(d) The Contractor shall insert the substance of this clause, including this paragraph (d), in each subcontract that, when entered into, exceeds the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1).

(End of clause)

21 52.214-34 SUBMISSION OF OFFERS IN THE ENGLISH LANGUAGE (APR 1991)

Offers submitted in response to this solicitation shall be in the English language. Offers received in other than English shall be rejected.

(End of provision)

22 52.214-35 SUBMISSION OF OFFERS IN U.S. CURRENCY (APR 1991)

Offers submitted in response to this solicitation shall be in terms of U.S. dollars. Offers received in other than U.S. dollars shall be rejected.

(End of provision)

23 52.217-5 EVALUATION OF OPTIONS (JUL 1990)

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

(End of provision)

24 52.217-7 OPTION FOR INCREASED QUANTITY--SEPARATELY PRICED LINE ITEM
(MAR 1989)

The Government may require the delivery of the numbered line item, identified in the Schedule as an option item, in the quantity and at the price stated in the Schedule. The Contracting Officer may exercise the option by written notice to the Contractor within 30 days. Delivery of added items shall continue at the same rate that like items are called for under the contract, unless the parties otherwise agree.

(End of clause)

25 52.219-8 UTILIZATION OF SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED
SMALL BUSINESS CONCERNS (JUN 1997)

(a) It is the policy of the United States that small business concerns, small business concerns owned and controlled by socially and economically disadvantaged individuals and small business concerns owned and controlled by women shall have the maximum practicable opportunity to participate in performing contracts let by any Federal agency, including contracts and subcontracts for subsystems, assemblies, components, and related services for major systems. It is further the policy of the United States that its prime contractors establish procedures to ensure the timely payment of amounts due pursuant to the terms of their subcontracts with small business concerns, small business concerns owned and controlled by socially and economically disadvantaged individuals and small business concerns owned and controlled by women.

(b) The Contractor hereby agrees to carry out this policy in the awarding of subcontracts to the fullest extent consistent with efficient contract performance. The Contractor further agrees to cooperate in any studies or surveys as may be conducted by the United States Small Business Administration or the awarding agency of the United States as may be necessary to determine the extent of the Contractor's compliance with this clause.

(c) As used in this contract, the term "small business concern" shall mean a small business as defined pursuant to section 3 of the Small Business Act and relevant regulations promulgated pursuant thereto. The term "small business concern owned and controlled by socially and economically disadvantaged individuals" shall mean a small business concern (1) which is at least 51 percent unconditionally owned by one or more socially and economically disadvantaged individuals; or, in the case of any publicly owned business, at least 51 per cent of the stock of which is unconditionally owned by one or more socially and economically disadvantaged individuals; and (2) whose management and daily business operations are controlled by one or more of such individuals. This term also means a small business concern that is at least 51 percent unconditionally owned by an economically disadvantaged Indian tribe or Native Hawaiian Organization, or a publicly owned business having at least 51 percent of its stock unconditionally owned by one of these entities which has its management and daily business controlled by members of an economically disadvantaged Indian tribe or Native Hawaiian Organization, and which meets the requirements of 13 CFR 124. The Contractor shall presume that socially and economically disadvantaged individuals include Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, Subcontinent Asian Americans, and other minorities, or any other individual found to be disadvantaged by the Administration pursuant to section 8(a) of the Small Business Act. The Contractor shall presume that socially and economically disadvantaged entities also include Indian Tribes and Native Hawaiian Organizations.

(d) The term "small business concern owned and controlled by women" shall mean a small business concern (1) which is at least 51 percent owned by one or more women, or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women, and (2) whose management and daily business operations are controlled by one or more women; and

(e) Contractors acting in good faith may rely on written representations by their subcontractors regarding their status as a small business concern, a small business concern owned and controlled by socially and economically disadvantaged individuals or a small business concern owned and controlled by women.

(End of clause)

26 52.219-9 I SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS
SUBCONTRACTING PLAN (AUG 1996)--ALTERNATE I (OCT 1995)

(a) This clause does not apply to small business concerns.

(b) "Commercial product," as used in this clause, means a product in regular production that is sold in substantial quantities to the general public and/or industry at established catalog or market prices. It also means a product which, in the opinion of the Contracting Officer, differs only insignificantly from the Contractor's commercial product.

"Subcontract," as used in this clause, means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(c) The apparent low bidder, upon request by the Contracting Officer, shall submit a subcontracting plan, where applicable, which separately addresses subcontracting with small business concerns, with small disadvantaged business concerns and with women-owned small business concerns. If the bidder is submitting an individual contract plan, the plan must separately address subcontracting with small business concerns, small disadvantaged business concerns and women-owned small business concerns, with a separate part for the basic contract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant contract. The subcontracting plan shall be submitted within the time specified by the Contracting Officer. Failure to submit the subcontracting plan shall make the bidder ineligible for the award of a contract.

(d) The offeror's subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business concerns, small disadvantaged business concerns and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may include a proportionate share of products and services that are normally allocated as indirect costs.

(2) A statement of--

- (i) Total dollars planned to be subcontracted;
- (ii) Total dollars planned to be subcontracted to small business concerns;
- (iii) Total dollars planned to be subcontracted to small disadvantaged business concerns; and
- (iv) Total dollars planned to be subcontracted to women-owned small business concerns.

(3) A description of the principal types of supplies and services to be subcontracted, and an identification of the types planned for subcontracting to (i) small business concerns, (ii) small disadvantaged business concerns and (iii) women-owned small business concerns.

(4) A description of the method used to develop the subcontracting goals in paragraph (d)(1) of this clause.

(5) A description of the method used to identify potential sources for solicitation purposes (e.g., existing company source lists, the Procurement Automated Source System (PASS) of the Small Business Administration, the National Minority Purchasing Council Vendor Information Service, the Research and Information Division of the Minority Business Development Agency in the Department of Commerce, or small, small disadvantaged and women-owned small business concerns trade associations). A firm may rely on the information contained in PASS as an accurate representation of a concern's size and ownership

characteristics for purposes of maintaining a small business source list. A firm may rely on PASS as its small business source list. Use of the PASS as its source list does not relieve a firm of its responsibilities (e.g., outreach, assistance, counseling, publicizing subcontracting opportunities) in this clause.

(6) A statement as to whether or not the offeror included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with (i) small business concerns, (ii) small disadvantaged business concerns, and (iii) women-owned small business concerns.

(7) The name of the individual employed by the offeror who will administer the offeror's subcontracting program, and a description of the duties of the individual.

(8) A description of the efforts the offeror will make to assure that small, small disadvantaged and women-owned small business concerns have an equitable opportunity to compete for subcontracts.

(9) Assurances that the offeror will include the clause in this contract entitled "Utilization of Small, Small Disadvantaged and Women-Owned Small Business Concerns" in all subcontracts that offer further subcontracting opportunities, and that the offeror will require all subcontractors (except small business concerns) who receive subcontracts in excess of \$500,000 (\$1,000,000 for construction of any public facility) to adopt a plan similar to the plan agreed to by the offeror.

(10) Assurances that the offeror will (i) cooperate in any studies or surveys as may be required, (ii) submit periodic reports in order to allow the Government to determine the extent of compliance by the offeror with the subcontracting plan, (iii) submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and/or SF 295, Summary Subcontract Report, in accordance with the instructions on the forms, and (iv) ensure that its subcontractors agree to submit Standard Forms 294 and 295.

(11) A recitation of the types of records the offeror will maintain to demonstrate procedures that have been adopted to comply with the requirements and goals in the plan, including establishing source lists; and a description of its efforts to locate small, small disadvantaged and women-owned small business concerns and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated):

(i) Source lists (e.g., PASS), guides, and other data that identify small, small disadvantaged and women-owned small business concerns.

(ii) Organizations contacted in an attempt to locate sources that are small, small disadvantaged or women-owned small business concerns.

(iii) Records on each subcontract solicitation resulting in an award of more than \$100,000, indicating (A) whether small business concerns were solicited and if not, why not, (B) whether small disadvantaged business concerns were solicited and if not, why not, (C) whether women-owned small business concerns were solicited and if not, why not, and (D) if applicable, the reason award was not made to a small business concern.

(iv) Records of any outreach efforts to contact (A) trade associations, (B) business development organizations, and (C) conferences and trade fairs to locate small, small disadvantaged and women-owned small business sources.

(v) Records of internal guidance and encouragement provided to buyers through (A) workshops, seminars, training, etc., and (B) monitoring performance to evaluate compliance with the program's requirements.

(vi) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having company or division-wide annual plans need not comply with this requirement.

(e) In order to effectively implement this plan to the extent consistent with efficient contract performance, the Contractor shall perform the following functions:

(1) Assist small, small disadvantaged and women-owned small business concerns by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation by such concerns. Where the contractor's lists of potential small, small disadvantaged and women-owned small business subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.

(2) Provide adequate and timely consideration of the potentialities of small, small disadvantaged and women-owned small business concerns in all "make-or-buy" decisions.

(3) Counsel and discuss subcontracting opportunities with representatives of small, small disadvantaged and women-owned small business firms.

(4) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as small, small disadvantaged or women-owned small business for the purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the Contractor's subcontracting plan.

(f) A master subcontracting plan on a plant or division-wide basis which contains all the elements required by (d) above, except goals, may be incorporated by reference as a part of the subcontracting plan required of the offeror by this clause; provided, (1) the master plan has been approved, (2) the offeror provides copies of the approved master plan and evidence of its approval to the Contracting Officer, and (3) goals and any deviations from the master plan deemed necessary by the Contracting Officer to satisfy the requirements of this contract are set forth in the individual subcontracting plan.

(g)(1) If a commercial product is offered, the subcontracting plan required by this clause may relate to the offeror's production generally, for both commercial and noncommercial products, rather than solely to the Government contract. In these cases, the offeror shall, with the concurrence of the Contracting Officer, submit one company-wide or division-wide annual plan.

(2) The annual plan shall be reviewed for approval by the agency awarding the offeror its first prime contract requiring a subcontracting plan during the fiscal year, or by an agency satisfactory to the Contracting Officer.

(3) The approved plan shall remain in effect during the offeror's fiscal year for all of the offeror's commercial products.

(h) Prior compliance of the offeror with other such subcontracting plans under previous contracts will be considered by the Contracting Officer in determining the responsibility of the offeror for award of the contract.

(i) The failure of the Contractor or subcontractor to comply in good faith with (1) the clause of this contract entitled "Utilization Of Small, Small Disadvantaged and Women-Owned Small Business Concerns," or (2) an approved plan required by this clause, shall be a material breach of the contract.

(End of clause)

27 52.219-16 LIQUIDATED DAMAGES--SUBCONTRACTING PLAN (OCT 1995)

(a) "Failure to make a good faith effort to comply with the subcontracting plan," as used in this clause, means a willful or intentional failure to perform in accordance with the requirements of the subcontracting plan approved under the clause in this contract entitled "Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan," or willful or intentional action to frustrate the plan.

(b) If, at contract completion, or in the case of a commercial product plan, at the close of the fiscal year for which the plan is applicable, the Contractor has failed to meet its subcontracting goals and the Contracting Officer decides in accordance with paragraph (c) of this clause that the Contractor failed to make a good faith effort to comply with its subcontracting plan, established in accordance with the clause in this contract entitled "Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan," the Contractor shall pay the Government liquidated damages in an amount stated. The amount of probable damages attributable to the Contractor's failure to comply, shall be an amount equal to the actual dollar amount by which the Contractor failed to achieve each subcontract goal or, in the case of a commercial products plan, that portion of the dollar amount allocable to Government contracts by which the Contractor failed to achieve each subcontract goal.

(c) Before the Contracting Officer makes a final decision that the Contractor has failed to make such good faith effort, the Contracting Officer shall give the Contractor written notice specifying the failure and permitting the Contractor to demonstrate what good faith efforts have been made. Failure to respond to the notice may be taken as an admission that no valid explanation exists. If, after consideration of all the pertinent data, the Contracting Officer finds that the Contractor failed to make a good faith effort to comply with the subcontracting plan, the Contracting Officer shall issue a final decision to that effect and require that the Contractor pay the Government liquidated damages as provided in paragraph (b) of this clause.

(d) With respect to commercial product plans; i.e., company-wide or division-wide subcontracting plans approved under paragraph (g) of the clause in this contract entitled "Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan," the Contracting Officer of the agency that originally approved the plan will exercise the functions of the Contracting Officer under this clause on behalf of all agencies that awarded contracts covered by that commercial product plan.

(e) The Contractor shall have the right of appeal, under the clause in this contract entitled, Disputes, from any final decision of the Contracting Officer.

(f) Liquidated damages shall be in addition to any other remedies that the Government may have.

(End of clause)

28 52.219-4001 NATIVE AMERICAN GRAVES PROTECTION (JAN 1993) (52.0219-4001)

(a) The Native American Graves Protection and Repatriation Act, hereinafter referred to as "the Act", enacted November 16, 1990, (Public Law 101-601, 25 U.S. Code) is applicable to this contract.

(b) The contractor may discover Native American human remains and objects, as defined in the Act, during contract execution. In the event of such discovery the contractor shall immediately cease activity in the area of the discovery and shall immediately notify the contracting officer of the discovery. The contractor shall make a reasonable effort to protect the items discovered in accordance with the Act and before resuming activity in the area. Fines and penalties for illegal trafficking in Native American human remains and cultural items are as defined in the Act.

(c) Upon receipt of notification of the discovery, the contracting officer will notify the appropriate authorities as required by the Act. The cessation of the activity in the area shall be for a minimum period of 30 days after the contracting officer has received certification of receipt of notification from the appropriate authorities, in accordance with the Act.

(d) The contractor shall not resume activity in the area of the discovery until the contracting officer has given the contractor notice that the contractor may resume the activity.

29 52.219-7003 SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN (DoD CONTRACTS) (APR 1996)

This clause supplements the Federal Acquisition Regulation 52.219-9, Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan, clause of this contract.

(a) Definitions.

"Historically black colleges and universities," as used in this clause, means institutions determined by the Secretary of Education to meet the requirements of 34 CFR 608.2. The term also means any nonprofit research institution that was an integral part of such a college or university before November 14, 1986.

"Minority institutions," as used in this clause, means institutions meeting the requirements of section 1046(3) of the Higher Education Act of 1965 (20 U.S.C. 1135d-5(3)). The term also includes Hispanic-serving institutions as defined in section 316(b)(1) of such Act (20 U.S.C. 1059c(b)(1)).

(b) Except for company or division-wide commercial items subcontracting plans, the term "small disadvantaged business," when used in the FAR 52.219-9 clause, includes historically black colleges and universities and minority institutions, in addition to small disadvantaged business concerns.

(c) Work under the contract or its subcontracts shall be credited toward meeting the small disadvantaged business concern goal required by paragraph (d) of the FAR 52.219-9 clause when:

(1) It is performed on Indian lands or in joint venture with an Indian tribe or a tribally-owned corporation, and

(2) It meets the requirements of 10 U.S.C. 2323a.

(d) Subcontracts awarded to workshops approved by the Committee for Purchase from People Who are Blind or Severely Disabled (41 U.S.C. 46-48), may be counted toward the Contractor's small business subcontracting goal.

(e) A mentor firm, under the Pilot Mentor-Protege Program established under Section 831 of Pub. L. 101-510, as amended, may count toward its small disadvantaged business goal, subcontracts awarded--

(1) Protege firms which are qualified organizations employing the severely handicapped; and

(2) Former protege firms that meet the criteria in Section 831(g)(4) of Pub. L. 101-510.

(f) The master plan approval referred to in paragraph (f) of the FAR 52.219-9 clause is approval by the Contractor's cognizant contract administration activity.

(g) In those subcontracting plans which specifically identify small, small disadvantaged, and women-owned small businesses, the Contractor shall notify the Administrative Contracting Officer of any substitutions of firms that are not small, small disadvantaged, or women-owned small businesses for the firms listed in the subcontracting plan. Notifications shall be in writing and shall occur within a reasonable period of time after award of the subcontract. Contractor-specified formats shall be acceptable.

(End of clause)

30 52.222-1 NOTICE TO THE GOVERNMENT OF LABOR DISPUTES (FEB 1997)

If the Contractor has knowledge that any actual or potential labor dispute is delaying or threatens to delay the timely performance of this contract, the Contractor shall immediately give notice, including all relevant information, to the Contracting Officer.

(End of clause)

31 52.222-3 CONVICT LABOR (AUG 1996)

The Contractor agrees not to employ in the performance of this contract any person undergoing a sentence of imprisonment which has been imposed by any court of a State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands. This limitation, however, shall not prohibit the employment by the Contractor in the performance of this contract of persons on parole or probation to work at paid employment during the term of their sentence or persons who have been pardoned or who have served their terms. Nor shall it prohibit the employment by the Contractor in the performance of this contract of persons confined for violation of the laws of any of the States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands who are authorized to work at paid employment in the community under the laws of such jurisdiction, if--

(a)(1) The worker is paid or is in an approved work training program on a voluntary basis;

(2) Representatives of local union central bodies or similar labor union organizations have been consulted;

(3) Such paid employment will not result in the displacement of employed workers, or be applied in skills, crafts, or trades in which there is a surplus of available gainful labor in the locality, or impair existing contracts for services; and

(4) The rates of pay and other conditions of employment will not be less than those paid or provided for work of a similar nature in the

locality in which the work is being performed; and

(b) The Attorney General of the United States has certified that the work-release laws or regulations of the jurisdiction involved are in conformity with the requirements of Executive Order 11755, as amended by Executive Orders 12608 and 12943.

(End of clause)

32 52.222-4 CONTRACT WORK HOURS AND SAFETY STANDARDS ACT--OVERTIME
COMPENSATION (JUL 1995)

(a) Overtime requirements. No Contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics (see Federal Acquisition Regulation (FAR) 22.300) shall require or permit any such laborers or mechanics in any workweek in which the individual is employed on such work to work in excess of 40 hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than 1 1/2 times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.

(b) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the provisions set forth in paragraph (a) of this clause, the Contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic employed in violation of the provisions set forth in paragraph (a) of this clause in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by provisions set forth in paragraph (a) of this clause.

(c) Withholding for unpaid wages and liquidated damages. The Contracting Officer shall upon his or her own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract or any other Federal contract with the same Prime Contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act which is held by the same Prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the provisions set forth in paragraph (b) of this clause.

(d) Payrolls and basic records. (1) The Contractor or subcontractor shall maintain payrolls and basic payroll records during the course of contract work and shall preserve them for a period of 3 years from the completion of the contract for all laborers and mechanics working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Nothing in this paragraph shall require the duplication of records required to be maintained for construction work by Department of Labor regulations at 29 CFR 5.5(a)(3) implementing the Davis-Bacon Act.

(2) The records to be maintained under paragraph (d)(1) of this clause shall be made available by the Contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or

subcontractor shall permit such representatives to interview employees during working hours on the job.

(e) Subcontracts. The Contractor or subcontractor shall insert in any subcontracts exceeding \$100,000, the provisions set forth in paragraphs (a) through (e) of this clause and also a clause requiring the subcontractors to include these provisions in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the provisions set forth in paragraphs (a) through (e) of this clause.

(End of clause)

33 52.222-6 DAVIS-BACON ACT (FEB 1995)

(a) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (d) of this clause; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such period. Such laborers and mechanics shall be paid not less than the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in the clause entitled Apprentices and Trainees. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (b) of this clause) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(b)(1) The Contracting Officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The Contracting Officer shall approve an additional classification and wage rate and fringe benefits therefor only when all the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination.

(ii) The classification is utilized in the area by the construction industry.

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(iv) With respect to helpers, such a classification prevails in the area in which the work is performed.

(2) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Contracting Officer agree on the classification and wage rate (including the amount designated for fringe benefits, where appropriate), a report of the action taken shall be sent by the Contracting Officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator or an authorized representative will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(3) In the event the Contractor, the laborers or mechanics to be employed in the classification, or their representatives, and the Contracting Officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the Contracting Officer shall refer the questions, including the views of all interested parties and the recommendation of the Contracting Officer, to the Administrator of the Wage and Hour Division for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits, where appropriate) determined pursuant to subparagraphs (b)(2) and (b)(3) of this clause shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(c) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(d) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided, that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(End of clause)

34 52.222-7 WITHHOLDING OF FUNDS (FEB 1988)

The Contracting Officer shall, upon his or her own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same Prime Contractor, or any other Federally assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same Prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by

the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(End of clause)

35 52.222-8 PAYROLLS AND BASIC RECORDS (FEB 1988)

(a) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under paragraph (d) of the clause entitled Davis-Bacon Act, that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(b)(1) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Contracting Officer. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under paragraph (a) of this clause. This information may be submitted in any form desired. Optional Form WH-347 (Federal Stock Number 029-005-00014-1) is available for this purpose and may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. The Prime Contractor is responsible for the submission of copies of payrolls by all subcontractors.

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify--

(i) That the payroll for the payroll period contains the information required to be maintained under paragraph (a) of this clause and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR Part 3;

and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph (b)(2) of this clause.

(4) The falsification of any of the certifications in this clause may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of Title 31 of the United States Code.

(c) The Contractor or subcontractor shall make the records required under paragraph (a) of this clause available for inspection, copying, or transcription by the Contracting Officer or authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit the Contracting Officer or representatives of the Contracting Officer or the Department of Labor to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit required records or to make them available, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(End of clause)

36 52.222-9 APPRENTICES AND TRAINEES (FEB 1988)

(a) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in this paragraph, shall be paid not less than the applicable wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program

for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(b) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(c) Equal employment opportunity. The utilization of apprentices, trainees, and journeymen under this clause shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

(End of clause)

37 52.222-10 COMPLIANCE WITH COPELAND ACT REQUIREMENTS (FEB 1988)

The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this contract.

(End of clause)

38 52.222-11 SUBCONTRACTS (LABOR STANDARDS) (FEB 1988)

(a) The Contractor or subcontractor shall insert in any subcontracts the clauses entitled Davis-Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Withholding of Funds, Subcontracts (Labor Standards), Contract Termination--Debarment, Disputes Concerning Labor Standards, Compliance with Davis-Bacon and Related Act Regulations, and Certification of Eligibility, and such other clauses as the Contracting Officer may, by appropriate instructions, require, and also a clause requiring subcontractors to include these clauses in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with all the contract clauses cited in this paragraph.

(b)(1) Within 14 days after award of the contract, the Contractor shall deliver to the Contracting Officer a completed Statement and Acknowledgment Form (SF 1413) for each subcontract, including the subcontractor's signed and dated acknowledgment that the clauses set forth in paragraph (a) of this clause have been included in the subcontract.

(2) Within 14 days after the award of any subsequently awarded subcontract the Contractor shall deliver to the Contracting Officer an updated completed SF 1413 for such additional subcontract.

(End of clause)

39 52.222-12 CONTRACT TERMINATION--DEBARMENT (FEB 1988)

A breach of the contract clauses entitled Davis-Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Subcontracts (Labor Standards), Compliance with Davis-Bacon and Related Act Regulations, or Certification of Eligibility may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 CFR 5.12.

(End of clause)

40 52.222-13 COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REGULATIONS (FEB 1988)

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are hereby incorporated by reference in this contract.

(End of clause)

41 52.222-14 DISPUTES CONCERNING LABOR STANDARDS (FEB 1988)

The United States Department of Labor has set forth in 29 CFR Parts 5, 6, and 7 procedures for resolving disputes concerning labor standards requirements. Such disputes shall be resolved in accordance with those procedures and not the Disputes clause of this contract. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees of their representatives.

(End of clause)

42 52.222-15 CERTIFICATION OF ELIGIBILITY (FEB 1988)

(a) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(c) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(End of clause)

43 52.222-27 AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR
CONSTRUCTION (DEVIATION) (APR 1984) (DEVIATION)

(a) Definitions.

"Covered area," as used in this clause, means the geographical area described in the solicitation for this contract.

"Deputy Assistant Secretary," as used in this clause, means the Deputy Assistant Secretary for Federal Contract Compliance Programs, United States Department of Labor or a designee.

"Employer's identification number," as used in this clause, means the Federal Social Security number used on the employer's quarterly federal tax return, U.S. Treasury Department Form 941.

"Minority," as used in this clause, means--

(1) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

(2) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands);

(3) Black (all persons having origins in any of the black African racial groups not of Hispanic origin); and

(4) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race).

(b) If the Contractor, or a subcontractor at any tier, subcontracts a portion of the work involving any construction trade, each such subcontract in excess of \$10,000 shall include this clause and the Notice containing the goals for minority and female participation stated in the solicitation for this contract.

(c) If the Contractor is participating in a Hometown Plan (41 CFR 60-4) approved by the U.S. Department of Labor in a covered area, either individually or through an association, its affirmative action obligations on all work in the plan area (including goals) shall comply with the plan for those trades that have unions participating in the plan. Contractors must be able to demonstrate participation in, and compliance with, the provisions of the plan. Each Contractor or subcontractor participating in an approved plan is also required to comply with its obligations under the Equal Opportunity clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good-faith performance by other Contractors or subcontractors toward a goal in an approved plan does not excuse any Contractor's or

subcontractor's failure to make good-faith efforts to achieve the plan's goals.

(d) The Contractor shall implement the affirmative action procedures in subparagraphs (g)(1) through (16) of this clause. The goals stated in the solicitation for this contract are expressed as percentages of the total hours of employment and training of minority and female utilization that the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for the geographical area where that work is actually performed. The Contractor is expected to make substantially uniform progress toward its goals in each craft.

(e) Neither the terms and conditions of any collective bargaining agreement, nor the failure by a union with which the Contractor has a collective bargaining agreement, to refer minorities or women shall excuse the Contractor's obligations under this clause, Executive Order 11246, as amended, or the regulations thereunder.

(f) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

(g) The Contractor shall take affirmative action to ensure equal employment opportunity. The evaluation of the Contractor's compliance with this clause shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully and implement affirmative action steps at least as extensive as the following:

(1) Ensure a working environment free of harassment, intimidation, and coercion at all sites and in all facilities where the Contractor's employees are assigned to work. The Contractor, if possible, will assign two or more women to each construction project. The Contractor shall ensure that foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at these sites or facilities.

(2) Establish and maintain a current list of sources for minority and female recruitment. Provide written notification to minority and female recruitment sources and community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

(3) Establish and maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant, referrals of minorities or females from unions, recruitment sources, or community organizations, and the action taken with respect to each individual. If an individual was sent to the union hiring hall for referral and not referred back to the Contractor by the union or, if referred back, not employed by the Contractor, this shall be documented in the file, along with whatever additional actions the Contractor may have taken.

(4) Immediately notify the Deputy Assistant Secretary when the union or unions with which the Contractor has a collective bargaining agreement has not referred back to the Contractor a minority or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

(5) Develop on-the-job training opportunities and/or participate in training programs for the area that expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under subparagraph (g)(2) above.

(6) Disseminate the Contractor's equal employment policy by--

(i) Providing notice of the policy to unions and to training, recruitment, and outreach programs, and requesting their cooperation in assisting the Contractor in meeting its contract obligations;

(ii) Including the policy in any policy manual and in collective bargaining agreements;

(iii) Publicizing the policy in the company newspaper, annual report, etc.;

(iv) Reviewing the policy with all management personnel and with all minority and female employees at least once a year; and

(v) Posting the policy on bulletin boards accessible to employees at each location where construction work is performed.

(7) Review, at least annually, the Contractor's equal employment policy and affirmative action obligations with all employees having responsibility for hiring, assignment, layoff, termination, or other employment decisions. Conduct review of this policy with all onsite supervisory personnel before initiating construction work at a job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

(8) Disseminate the Contractor's equal employment policy externally by including it in any advertising in the news media, specifically including minority and female news media. Provide written notification to, and discuss this policy with, other Contractors and subcontractors with which the Contractor does or anticipates doing business.

(9) Direct recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students, and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than 1 month before the date for acceptance of applications for apprenticeship or training by any recruitment source, send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

(10) Encourage present minority and female employees to recruit minority persons and women. Where reasonable, provide after-school, summer, and vacation employment to minority and female youth both on the site and in other areas of the Contractor's workforce.

(11) Validate all tests and other selection requirements where required under 41 CFR 60-3.

(12) Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities. Encourage these employees to seek or to prepare for, through appropriate training, etc., opportunities for promotion.

(13) Ensure that seniority practices job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment-related activities to ensure that the Contractor's obligations under this contract are being carried out.

(14) Ensure that all facilities and company activities are

nonsegregated except that separate or single-user rest rooms and necessary dressing or sleeping areas shall be provided to assure privacy between the sexes.

(15) Maintain a record of solicitations for subcontracts for minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

(16) Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's equal employment policy and affirmative action obligations.

(h) The Contractor is encouraged to participate in voluntary associations that may assist in fulfilling one or more of the affirmative action obligations contained in subparagraphs (g)(1) through (16). The efforts of a contractor association, joint contractor-union, contractor-community, or similar group of which the contractor is a member and participant may be asserted as fulfilling one or more of its obligations under subparagraphs (g)(1) through (16), provided the Contractor--

(1) Actively participates in the group;

(2) Makes every effort to ensure that the group has a positive impact on the employment of minorities and women in the industry;

(3) Ensures that concrete benefits of the program are reflected in the Contractor's minority and female workforce participation;

(4) Makes a good-faith effort to meet its individual goals and timetables; and

(5) Can provide access to documentation that demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply is the Contractor's, and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

(i) A single goal for minorities and a separate single goal for women shall be established. The Contractor is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and nonminority. Consequently, the Contractor may be in violation of Executive Order 11246, as amended, if a particular group is employed in a substantially disparate manner.

(j) The Contractor shall not use goals or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

(k) The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts under Executive Order 11246, as amended.

(l) The Contractor shall carry out such sanctions and penalties for violation of this clause and of the Equal Opportunity clause, including suspension, termination, and cancellation of existing subcontracts, as may be imposed or ordered under Executive Order 11246, as amended, and its implementing regulations, by the OFCCP. Any failure to carry out these sanctions and penalties as ordered shall be a violation of this clause and Executive Order 11246, as amended.

(m) The Contractor in fulfilling its obligations under this clause shall implement affirmative action procedures at least as extensive as those prescribed in paragraph (g) above, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of Executive Order 11246, as amended, the implementing regulations, or this clause, the Deputy Assistant Secretary shall take action as prescribed in 41 CFR 60-4.8.

(n) The Contractor shall designate a responsible official to--

(1) Monitor all employment-related activity to ensure that the Contractor's equal employment policy is being carried out;

(2) Submit reports as may be required by the Government; and

(3) Keep records that shall at least include for each employee the name, address, telephone number, construction trade, union affiliation (if any), employee identification number, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, separate records are not required to be maintained.

(o) Nothing contained herein shall be construed as a limitation upon the application of other laws that establish different standards of compliance or upon the requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

(End of clause)

44 52.222-26 EQUAL OPPORTUNITY (APR 1984) (DEVIATION) (DEVIATION)

(a) If, during any 12-month period (including the 12 months preceding the award of this contract), the Contractor has been or is awarded nonexempt Federal contracts and/or subcontracts that have an aggregate value in excess of \$10,000, the Contractor shall comply with subparagraphs (b)(1) through (11) below. Upon request, the Contractor shall provide information necessary to determine the applicability of this clause.

(b) During performing this contract, the Contractor agrees as follows:

(1) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. Note: It shall not be a violation of E.O. 11246 for a contractor to extend a publicly announced preference in employment to Indians living on or near an Indian reservation in connection with employment opportunities on or near an Indian reservation. See 22.807(b)(4).

(2) The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. This shall include, but not be limited to, (i) employment, (ii) upgrading, (iii) demotion, (iv) transfer, (v) recruitment or recruitment advertising, (vi) layoff or termination, (vii) rates of pay or other forms of compensation, and (viii) selection for training, including apprenticeship.

(3) The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.

(4) The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(5) The Contractor shall send, to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, the notice to be provided by the Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the

notice in conspicuous places available to employees and applicants for employment.

(6) The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

(7) The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor. The Contractor shall, within 30 days following the award, file Standard Form 100 (EEO-1), or any successor form, unless filed within 12 months preceding the date of award.

(8) The Contractor shall permit access to its premises by the contracting officer or the Office of Federal Contract Compliance Programs (OFCCP) for the purpose of conducting on-site compliance reviews and inspecting such books, records, accounts, and other materials as may be relevant to an investigation to ascertain the Contractor's compliance with the applicable rules, regulations, and orders.

(9) If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended; in the rules, regulations, and orders of the Secretary of Labor; or as otherwise provided by law.

(10) The Contractor shall include the terms and conditions of subparagraph (b)(1) through (11) of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontractor or vendor.

(11) The Contractor shall take such action with respect to any subcontract or purchase order as the contracting officer may direct as a means of enforcing these terms and conditions, including sanctions for noncompliance; provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of any direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

(c) Notwithstanding any other clause in this contract, disputes relative to this clause will be governed by the procedures in 41 CFR 60-1.1.

(End of clause)

45 52.222-35 AFFIRMATIVE ACTION FOR DISABLED VETERANS AND VETERANS OF
THE VIETNAM ERA (APR 1998)

(a) Definitions. As used in this clause--

"All employment openings" includes all positions except executive and top management, those positions that will be filled from within the contractor's organization, and positions lasting 3 days or less. This term includes full-time employment, temporary employment of more than 3 days' duration, and part-time employment.

"Appropriate office of the State employment service system" means the local office of the Federal-State national system of public employment offices with assigned responsibility to serve the area

where the employment opening is to be filled, including the District of Columbia, Guam, the Commonwealth of Puerto Rico, and the Virgin Islands.

"Positions that will be filled from within the Contractor's organization" means employment openings for which no consideration will be given to persons outside the Contractor's organization (including any affiliates, subsidiaries, and parent companies) and includes any openings that the Contractor proposes to fill from regularly established "recall" lists. The exception does not apply to a particular opening once an employer decides to consider applicants outside of its organization.

"Veteran of the Vietnam era" means a person who--

(1) Served on active duty for a period of more than 180 days, any part of which occurred between August 5, 1964, and May 7, 1975, and was discharged or released therefrom with other than a dishonorable discharge; or

(2) Was discharged or released from active duty for a service-connected disability if any part of such active duty was performed between August 5, 1964, and May 7, 1975.

(b) General. (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against the individual because the individual is a disabled veteran or a veteran of the Vietnam era. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified disabled veterans and veterans of the Vietnam era without discrimination based upon their disability or veterans' status in all employment practices such as--

(i) Employment;

(ii) Upgrading;

(iii) Demotion or transfer;

(iv) Recruitment;

(v) Advertising;

(vi) Layoff or termination;

(vii) Rates of pay or other forms of compensation; and

(viii) Selection for training, including apprenticeship.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Vietnam Era Veterans' Readjustment Assistance Act of 1972 (the Act), as amended.

(c) Listing openings. (1) The Contractor agrees to list all employment openings existing at contract award or occurring during contract performance, at an appropriate office of the State employment service system in the locality where the opening occurs. These openings include those occurring at any Contractor facility, including one not connected with performing this contract. An independent corporate affiliate is exempt from this requirement.

(2) State and local government agencies holding Federal contracts of \$10,000 or more shall also list all employment openings with the appropriate office of the State employment service.

(3) The listing of employment openings with the State employment service system is required at least concurrently with using any other recruitment source or effort and involves the obligations of placing a bona fide job order, including accepting referrals of veterans and nonveterans. This listing does not require hiring any particular job applicant or hiring from any particular group of job applicants and is not intended to relieve the Contractor from any requirements of Executive orders or regulations concerning nondiscrimination in

employment.

(4) Whenever the Contractor becomes contractually bound to the listing terms of this clause, it shall advise the State employment service system, in each State where it has establishments, of the name and location of each hiring location in the State. As long as the Contractor is contractually bound to these terms and has so advised the State system, it need not advise the State system of subsequent contracts. The Contractor may advise the State system when it is no longer bound by this contract clause.

(d) Applicability. This clause does not apply to the listing of employment openings that occur and are filled outside the 50 States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, and the Virgin Islands.

(e) Postings. (1) The Contractor agrees to post employment notices stating (i) the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam era, and (ii) the rights of applicants and employees.

(2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. They shall be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance Programs, Department of Labor (Deputy Assistant Secretary), and provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of the Act, and is committed to take affirmative action to employ, and advance in employment, qualified disabled veterans and veterans of the Vietnam era.

(f) Noncompliance. If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(g) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order of \$10,000 or more unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Deputy Assistant Secretary to enforce the terms, including action for noncompliance.

(End of clause)

46 52.222-36 AFFIRMATIVE ACTION FOR HANDICAPPED WORKERS (APR 1984)

(a) General. (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against any employee or applicant because of physical or mental handicap. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices such as--

- (i) Employment;
- (ii) Upgrading;
- (iii) Demotion or transfer;
- (iv) Recruitment;
- (v) Advertising;
- (vi) Layoff or termination;
- (vii) Rates of pay or other forms of compensation; and

(viii) Selection for training, including apprenticeship.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Rehabilitation Act of 1973 (29 U.S.C. 793) (the Act), as amended.

(b) Postings. (1) The Contractor agrees to post employment notices stating (i) the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified handicapped individuals and (ii) the rights of applicants and employees.

(2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. They shall be in a form prescribed by the Director, Office of Federal Contract Compliance Programs, Department of Labor (Director), and provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section 503 of the Act and is committed to take affirmative action to employ, and advance in employment, qualified physically and mentally handicapped individuals.

(c) Noncompliance. If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(d) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order in excess of \$2,500 unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Director to enforce the terms, including action for noncompliance.

(End of clause)
(R 7-103.28 1976 MAY)
(R FPR Temp. Reg. 38)

47 52.222-37 EMPLOYMENT REPORTS ON DISABLED VETERANS AND VETERANS OF
THE VIETNAM ERA (APR 1998)

(a) Unless the Contractor is a State or local government agency, the Contractor shall report at least annually, as required by the Secretary of Labor, on--

(1) The number of disabled veterans and the number of veterans of the Vietnam era in the workforce of the Contractor by job category and hiring location; and

(2) The total number of new employees hired during the period covered by the report, and of that total, the number of disabled veterans, and the number of veterans of the Vietnam era.

(b) The above items shall be reported by completing the form entitled "Federal Contractor Veterans' Employment Report VETS-100."

(c) Reports shall be submitted no later than March 31 of each year beginning March 31, 1988.

(d) The employment activity report required by paragraph (a)(2) of this clause shall reflect total hires during the most recent 12-month period as of the ending date selected for the employment profile report required by paragraph (a)(1) of this clause. Contractors may select an ending date:

(1) As of the end of any pay period during the period January through March 1st of the year the report is due, or (2) as of December 31, if the contractor has previous written approval from the Equal Employment Opportunity Commission to do so for purposes of submitting the Employer

Information Report EEO-1 (Standard Form 100).

(e) The count of veterans reported according to paragraph (a) of this clause shall be based on voluntary disclosure. Each Contractor subject to the reporting requirements at 38 U.S.C. 4212 shall invite all disabled veterans and veterans of the Vietnam era who wish to benefit under the affirmative action program at 38 U.S.C. 4212 to identify themselves to the Contractor. The invitation shall state that the information is voluntarily provided; that the information will be kept confidential; that disclosure or refusal to provide the information will not subject the applicant or employee to any adverse treatment; and that the information will be used only in accordance with the regulations promulgated under 38 U.S.C. 4212.

(f) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order of \$10,000 or more unless exempted by rules, regulations, or orders of the Secretary.

(End of clause)

48 52.223-2 CLEAN AIR AND WATER (APR 1984)

(a) "Air Act", as used in this clause, means the Clean Air Act (42 U.S.C. 7401, et seq.).

"Clean air standards," as used in this clause, means--

(1) Any enforceable rules, regulations, guidelines, standards, limitations, orders, controls, prohibitions, work practices, or other requirements contained in, issued under, or otherwise adopted under the Air Act or Executive Order 11738;

(2) An applicable implementation plan as described in section 110(d) of the Air Act (42 U.S.C. 7410(d));

(3) An approved implementation procedure or plan under section 111(c) or section 111(d) of the Air Act (42 U.S.C. 7411(c) or (d)); or

(4) An approved implementation procedure under section 112(d) of the Air Act (42 U.S.C. 7412(d)).

"Clean water standards," as used in this clause, means any enforceable limitation, control, condition, prohibition, standard, or other requirement promulgated under the Water Act or contained in a permit issued to a discharger by the EPA or by a State under an approved program, as authorized by section 402 of the Water Act (33 U.S.C. 1342), or by local government to ensure compliance with pretreatment regulations as required by section 307 of the Water Act (33 U.S.C. 1317).

"Compliance," as used in this clause, means compliance with--

(1) Clean air or water standards; or

(2) A schedule or plan ordered or approved by a court of competent jurisdiction, the EPA, or an air or water pollution control agency under the requirements of the Air Act or Water Act and related regulations.

"Facility," as used in this clause, means any building, plant, installation, structure, mine, vessel or other floating craft, location, or site of operations, owned, leased, or supervised by a Contractor or subcontractor, used in the performance of a contract or subcontract. When a location or site of operations includes more than one building, plant, installation, or structure, the entire location or site shall be deemed a facility except when the Administrator, or a designee, of the EPA determines that independent facilities are collocated in one geographical area.

"Water Act," as used in this clause, means Clean Water Act (33 U.S.C. 1251, et seq.).

(b) The Contractor agrees--

(1) To comply with all the requirements of section 114 of the Clean Air Act (42 U.S.C. 7414) and section 308 of the Clean Water Act (33 U.S.C. 1318) relating to inspection, monitoring, entry, reports, and information, as well as other requirements specified in section 114 and section 308 of the Air Act and the Water Act, and all regulations and guidelines issued to implement those acts before the award of this contract;

(2) That no portion of the work required by this prime contract will be performed in a facility listed on the EPA List of Violating Facilities on the date when this contract was awarded unless and until the EPA eliminates the name of the facility from the listing;

(3) To use best efforts to comply with clean air standards and clean water standards at the facility in which the contract is being performed; and

(4) To insert the substance of this clause into any nonexempt subcontract, including this subparagraph (b)(4).

(End of clause)
(R 7-103.29 1975 OCT)
(R 1-1.2302)

49 52.223-3 HAZARDOUS MATERIAL IDENTIFICATION AND MATERIAL SAFETY DATA
(JAN 1997)

(a) "Hazardous material," as used in this clause, includes any material defined as hazardous under the latest version of Federal Standard No. 313 (including revisions adopted during the term of the contract).

(b) The Offeror must list any hazardous material, as defined in paragraph (a) of this clause, to be delivered under this contract. The hazardous material shall be properly identified and include any applicable identification number, such as National Stock Number or Special Item Number. This information shall also be included on the Material Safety Data Sheet submitted under this contract.

Material	Identification No.
(If none, insert None)	

(c) This list must be updated during performance of the contract whenever the Contractor determines that any other material to be delivered under this contract is hazardous.

(d) The apparently successful Offeror agrees to submit, for each item as required prior to award, a Material Safety Data Sheet, meeting the requirements of 29 CFR 1910.1200(g) and the latest version of Federal Standard No. 313, for all hazardous material identified in paragraph (b) of this clause. Data shall be submitted in accordance with Federal Standard No. 313, whether or not the apparently successful Offeror is the actual manufacturer of these items. Failure to submit the Material Safety Data Sheet prior to award may result in the apparently successful Offeror being considered nonresponsible and ineligible for award.

(e) If, after award, there is a change in the composition of the item(s) or a revision to Federal Standard No. 313, which renders incomplete or inaccurate the data submitted under paragraph (d) of this clause, the Contractor shall promptly notify the Contracting Officer and resubmit the data.

(f) Neither the requirements of this clause nor any act or failure to act by the Government shall relieve the Contractor of any responsibility or

liability for the safety of Government, Contractor, or subcontractor personnel or property.

(g) Nothing contained in this clause shall relieve the Contractor from complying with applicable Federal, State, and local laws, codes, ordinances, and regulations (including the obtaining of licenses and permits) in connection with hazardous material.

(h) The Government's rights in data furnished under this contract with respect to hazardous material are as follows:

(1) To use, duplicate and disclose any data to which this clause is applicable. The purposes of this right are to--

(i) Apprise personnel of the hazards to which they may be exposed in using, handling, packaging, transporting, or disposing of hazardous materials;

(ii) Obtain medical treatment for those affected by the material; and

(iii) Have others use, duplicate, and disclose the data for the Government for these purposes.

(2) To use, duplicate, and disclose data furnished under this clause, in accordance with subparagraph (h)(1) of this clause, in precedence over any other clause of this contract providing for rights in data.

(3) The Government is not precluded from using similar or data acquired from other sources.

(End of clause)

50 52.223-5 POLLUTION PREVENTION AND RIGHT-TO-KNOW INFORMATION (APR 1998)

(a) Executive Order 12856 of August 3, 1993, requires Federal facilities to comply with the provisions of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11001-11050) and the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13101-13109).

(b) The Contractor shall provide all information needed by the Federal facility to comply with the emergency planning reporting requirements of Section 302 of EPCRA; the emergency notice requirements of Section 304 of EPCRA; the list of Material Data Safety Sheets required by Section 311 of EPCRA; the emergency and hazardous chemical inventory forms of Section 312 of EPCRA; the toxic chemical release inventory of Section 313 of EPCRA, which includes the reduction and recycling information required by Section 6607 of PPA; and the toxic chemical reduction goals requirements of Section 3-302 of Executive Order 12856.

(End of clause)

51 52.223-6 DRUG-FREE WORKPLACE (JAN 1997)

(a) Definitions. As used in this clause--

"Controlled substance" means a controlled substance in schedules I through V of section 202 of the Controlled Substances Act (21 U.S.C. 812) and as further defined in regulation at 21 CFR 1308.11 - 1308.15.

"Conviction" means a finding of guilt (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statutes.

"Criminal drug statute" means a Federal or non-Federal criminal statute involving the manufacture, distribution, dispensing, possession or use of any controlled substance.

"Drug-free workplace" means the site(s) for the performance of work done by the Contractor in connection with a specific contract at which employees of the Contractor are prohibited from engaging in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance.

"Employee" means an employee of a Contractor directly engaged in the performance of work under a Government contract. "Directly engaged" is defined to include all direct cost employees and any other Contractor employee who has other than a minimal impact or involvement in contract performance.

"Individual" means an offeror/contractor that has no more than one employee including the offeror/contractor.

(b) The Contractor, if other than an individual, shall--within 30 days after award (unless a longer period is agreed to in writing for contracts of 30 days or more performance duration), or as soon as possible for contracts of less than 30 days performance duration--

(1) Publish a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition;

(2) Establish an ongoing drug-free awareness program to inform such employees about--

(i) The dangers of drug abuse in the workplace;

(ii) The Contractor's policy of maintaining a drug-free workplace;

(iii) Any available drug counseling, rehabilitation, and employee assistance programs; and

(iv) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;

(3) Provide all employees engaged in performance of the contract with a copy of the statement required by subparagraph (b)(1) of this clause;

(4) Notify such employees in writing in the statement required by subparagraph (b)(1) of this clause that, as a condition of continued employment on this contract, the employee will--

(i) Abide by the terms of the statement; and

(ii) Notify the employer in writing of the employee's conviction under a criminal drug statute for a violation occurring in the workplace no later than 5 days after such conviction.

(5) Notify the Contracting Officer in writing within 10 days after receiving notice under subdivision (b)(4)(ii) of this clause, from an employee or otherwise receiving actual notice of such conviction. The notice shall include the position title of the employee;

(6) Within 30 days after receiving notice under subdivision (b)(4)(ii) of this clause of a conviction, take one of the following actions with respect to any employee who is convicted of a drug abuse violation occurring in the workplace:

(i) Taking appropriate personnel action against such employee, up to and including termination; or

(ii) Require such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency, and

(7) Make a good faith effort to maintain a drug-free workplace through implementation of subparagraphs (b)(1) through (b)(6) of this clause.

(c) The Contractor, if an individual, agrees by award of the contract or acceptance of a purchase order, not to engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance

while performing this contract.

(d) In addition to other remedies available to the Government, the Contractor's failure to comply with the requirements of paragraph (b) or (c) of this clause may, pursuant to FAR 23.506, render the Contractor subject to suspension of contract payments, termination of the contract for default, and suspension or debarment.

(End of clause)

52 52.223-14 TOXIC CHEMICAL RELEASE REPORTING (OCT 1996)

(a) Unless otherwise exempt, the Contractor, as owner or operator of a facility used in the performance of this contract, shall file by July 1 for the prior calendar year an annual Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023(a) and (g)), and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106). The Contractor shall file, for each facility subject to the Form R filing and reporting requirements, the annual Form R throughout the life of the contract.

(b) A Contractor owned or operated facility used in the performance of this contract is exempt from the requirement to file an annual Form R if--

(1) The facility does not manufacture, process, or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

(2) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);

(3) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

(4) The facility does not fall within Standard Industrial Classification Code (SIC) designations 20 through 39 as set forth in Section 19.102 of the Federal Acquisition Regulation (FAR); or

(5) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

(c) If the Contractor has certified to an exemption in accordance with one or more of the criteria in paragraph (b) of this clause, and after award of the contract circumstances change so that any of its owned or operated facilities used in the performance of this contract is no longer exempt--

(1) The Contractor shall notify the Contracting Officer; and

(2) The Contractor, as owner or operator of a facility used in the performance of this contract that is no longer exempt, shall (i) submit a Toxic Chemical Release Inventory Form (Form R) on or before July 1 for the prior calendar year during which the facility becomes eligible; and (ii) continue to file the annual Form R for the life of the contract for such facility.

(d) The Contracting Officer may terminate this contract or take other action as appropriate, if the Contractor fails to comply accurately and fully with the EPCRA and PPA toxic chemical release filing and reporting requirements.

(e) Except for acquisitions of commercial items as defined in FAR Part 2, the Contractor shall--

(1) For competitive subcontracts expected to exceed \$100,000 (including

all options), include a solicitation provision substantially the same as the provision at FAR 52.223-13, Certification of Toxic Chemical Release Reporting; and

(2) Include in any resultant subcontract exceeding \$100,000 (including all options), the substance of this clause, except this paragraph (e).

(End of clause)

53 52.223-7001 HAZARD WARNING LABELS (DEC 1991)

(a) "Hazardous material," as used in this clause, is defined in the Hazardous Material Identification and Material Safety Data clause of this contract.

(b) The Contractor shall label the item package (unit container) of any hazardous material to be delivered under this contract in accordance with the Hazard Communication Standard (29 CFR 1910.1200 et seq.). The Standard requires that the hazard warning label conform to the requirements of the standard unless the material is otherwise subject to the labeling requirements of one of the following statutes:

- (1) Federal Insecticide, Fungicide and Rodenticide Act;
- (2) Federal Food, Drug and Cosmetics Act;
- (3) Consumer Product Safety Act;
- (4) Federal Hazardous Substances Act; or
- (5) Federal Alcohol Administration Act.

(c) The Offeror shall list which hazardous material listed in the Hazardous Material Identification and Material Safety Data clause of this contract will be labeled in accordance with one of the Acts in paragraphs (b)(1) through (5) of this clause instead of the Hazard Communication Standard. Any hazardous material not listed will be interpreted to mean that a label is required in accordance with the Hazard Communication Standard.

Material (if none, insert "none.")	Act
_____	_____
_____	_____
_____	_____

(d) The apparently successful Offeror agrees to submit, before award, a copy of the hazard warning label for all hazardous materials not listed in paragraph (c) of this clause. The Offeror shall submit the label with the Material Safety Data Sheet being furnished under the Hazardous Material Identification and Material Safety Data clause of this contract.

(e) The Contractor shall also comply with MIL-STD-129, Marking for Shipment and Storage (including revisions adopted during the term of this contract).

(End of clause)

54 52.223-7006 PROHIBITION ON STORAGE AND DISPOSAL OF TOXIC AND HAZARDOUS MATERIALS (APR 1993)

(a) Definitions. As used in this clause--

(1) "Storage" means a non-transitory, semi-permanent or permanent holding, placement, or leaving of material. It does not include a temporary accumulation of a limited quantity of a material used in or a waste generated or resulting from authorized activities, such as

servicing, maintenance, or repair of Department of Defense (DoD) items, equipment, or facilities.

(2) "Toxic or hazardous materials" means:

(i) Materials referred to in section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 U.S.C. 9601(14)) and materials designated under section 102 of CERCLA (42 U.S.C. 9602)(40 CFR Part 302);

(ii) Materials that are of an explosive, flammable, or pyrotechnic nature; or

(iii) Materials otherwise identified by the Secretary of Defense as specified in DoD regulations.

(b) In accordance with 10 U.S.C. 2692, the Contractor is prohibited from storing or disposing of non-DoD-owned toxic or hazardous materials on a DoD installation, except to the extent authorized by a statutory exception to 10 U.S.C. 2692 or as authorized by the Secretary of Defense or his designee.

(End of clause)

55 52.225-11 RESTRICTIONS ON CERTAIN FOREIGN PURCHASES (OCT 1996)

(a) Unless advance written approval of the Contracting Officer is obtained, the Contractor shall not acquire, for use in the performance of this contract, any supplies or services originating from sources within, or that were located in or transported from or through, countries whose products are banned from importation into the United States under regulations of the Office of Foreign Assets Control, Department of the Treasury. Those countries include Cuba, Iran, Iraq, Libya, and North Korea.

(b) The Contractor shall not acquire for use in the performance of this contract any supplies or services from entities controlled by the Government of Iraq.

(c) The Contractor agrees to insert the provisions of this clause, including this paragraph (c), in all subcontracts hereunder.

(End of clause)

56 52.225-13 NOTICE OF BUY AMERICAN ACT REQUIREMENT--CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS ACT AND NORTH AMERICAN FREE TRADE AGREEMENT (MAY 1997)

(a) Offerors are required to comply with the requirements of Federal Acquisition Regulation (FAR) clause 52.225-15, Buy American Act--Construction Materials Under Trade Agreements Act and North American Free Trade Agreement, of this solicitation. The terms defined in FAR clause 52.225-15 have the same meaning in this provision.

(b) Offerors should request a determination regarding the inapplicability of the Buy American Act in time to allow determination before submission of offers. For evaluation of a request for a determination regarding the inapplicability of the requirements of the Buy American Act prior to the time set for receipt of offers, the information and applicable supporting data required by paragraphs (c) and (d) of FAR clause 52.225-15 shall be included in the request. If an offeror has not requested a determination regarding the inapplicability of the Buy American Act prior to submission of its offer, or has not received a response to a request made prior to submission of its offer, the information and supporting data shall be included in the offer.

(c) Evaluation of offers.

(1) For evaluation of offers, (unless agency regulations specify a higher percentage) the Government will add to the offered price 6 percent of the cost of any foreign construction material proposed for exception from the requirements of the Buy American Act based on claimed unreasonable cost of domestic construction materials in accordance with paragraph (b)(4)(i) of FAR clause 52.225-15.

(2) If the evaluation of offers results in a tie between an offer including such foreign construction material excepted on the basis of unreasonable cost, as evaluated, and an offer including solely domestic construction material or other foreign construction material, listed in the solicitation at paragraph (b)(3) of FAR clause 52.225-15, or subsequently excepted in accordance with paragraphs (b)(4)(ii) or (iii) of FAR clause 52.225-15, award shall be made to the offeror that submitted the latter offer.

(d) Alternate offers.

(1) When an offer includes foreign construction material not listed by the Government in the solicitation at paragraph (b)(3) of FAR clause 52.225-15, offerors also may submit alternate offers based on use of equivalent domestic construction material.

(2) If alternate offers are submitted, a separate Standard Form 1442 shall be submitted for each alternate offer, and a separate price comparison table, prepared in accordance with paragraphs (c) and (d) of FAR clause 52.225-15, shall be submitted for each offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception to apply.

(3) If the Government determines that a particular exception requested under paragraph (c) of FAR clause 52.225-15 does not apply, the Government will evaluate only those offers based on use of the equivalent domestic construction material, and the offeror shall be required to furnish such domestic construction material.

(i) In sealed bid procurements, any offer based on use of that particular foreign construction material shall be rejected as nonresponsive.

(ii) in negotiated procurements, any offer based on use of that particular foreign construction material may not be accepted unless revised during negotiations.

(End of provision)

57 52.225-15 BUY AMERICAN ACT--CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS ACT AND NORTH AMERICAN FREE TRADE AGREEMENT (JUN 1997)

(a) Definitions. As used in this clause--

"Components" means those articles, materials, and supplies incorporated directly into construction materials.

"Construction material" means an article, material, or supply brought to the construction site for incorporation into the building or work. Construction material also includes an item brought to the site pre-assembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, which are discrete systems incorporated into a public building or work and which are produced as a complete system, shall be evaluated as a single and distinct construction material regardless of when or how the individual parts or components of such systems are delivered to the construction site.

"Designated country construction material" means a construction material that (a) is wholly the growth, product, or manufacture of a designated country (as defined at FAR 25.401), or (b) in the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a designated country into a new and different construction material distinct from the materials from which it was transformed.

"Domestic construction material" means (1) an unmanufactured construction material mined or produced in the United States, or (2) a construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind as the construction materials determined to be unavailable pursuant to subparagraph 25.202(a)(2) of the Federal Acquisition Regulation (FAR) shall be treated as domestic.

"North American Free Trade Agreement (NAFTA) country" means Canada or Mexico.

"NAFTA country construction material" means a construction material that (a) is wholly the growth, product, or manufacture of a NAFTA country, or (b) in the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a NAFTA country into a new and different construction material distinct from the materials from which it was transformed.

(b)(1) The Buy American Act (41 U.S.C. 10a--10d) requires that only domestic construction material be used in performing this contract, except as provided in paragraphs (b)(2), (b)(3), and (b)(4) of this clause.

(2) The Trade Agreements Act and the North American Free Trade Agreement (NAFTA) provide that designated country and NAFTA country construction materials are exempted from application of the Buy American Act.

(3) The requirement in paragraph (b)(1) of this clause does not apply to the excepted construction material or components listed by the Government as follows:

%%Insert list of applicable accepted materials or indicate "none"
none

(4) Other foreign construction material may be added to the list in paragraph (b)(3) of this clause if the Government determines that--

(i) The cost would be unreasonable (the cost of a particular domestic construction material shall be determined to be unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent, unless the agency head determines a higher percentage to be appropriate);

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or (iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(5) The Contractor agrees that only domestic construction materials, NAFTA country construction materials, or designated country construction materials will be used by the Contractor, subcontractors, material men, and suppliers in the performance of this contract, except for foreign construction materials, if any, listed in paragraph (b)(3) of this clause.

(c) Request for determination.

(1) Contractors requesting to use foreign construction material under paragraph (b)(4) of this clause shall provide adequate information for

Government evaluation of the request for a determination regarding the inapplicability of the Buy American Act. Each submission shall include a description of the foreign and domestic construction materials, including unit of measure, quantity, price, time of delivery or availability, location of the construction project, name and address of the proposed contractor, and a detailed justification of the reason for use of foreign materials cited in accordance with paragraph (b)(4) of this clause. A submission based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause. The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(2) If the Government determines after contract award that an exception to the Buy American Act applies, the contract shall be modified to allow use of the foreign construction material, and adequate consideration shall be negotiated. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration shall not be less than the differential established in paragraph (b)(4)(i) of this clause.

(3) If the Government does not determine that an exception to the Buy American Act applies, the use of that particular foreign construction material will be a failure to comply with the Act.

(d) For evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the following information and any applicable supporting data based on the survey of suppliers shall be included in the request:

Foreign and Domestic Construction Materials Price Comparison

Construction material description	Unit of measure	Quantity	Price (dollars) +
Item 1:			
Foreign construction material.....
Domestic construction material.....
Item 2:			
Foreign construction material.....
Domestic construction material.....

List name, address, telephone number, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary. Include other applicable supporting information.

+ Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued).

(End of clause)

58 52.225-7007 I TRADE AGREEMENTS (JUL 1997)--ALTERNATE I (JUN 1997)

(a) Definitions. As used in this clause--

(1) "Caribbean Basin country" means--

Antigua and Barbuda	Guyana
Aruba	Haiti
Bahamas	Honduras
Barbados	Jamaica
Belize	Montserrat
British Virgin Islands	Netherlands Antilles
Costa Rica	Nicaragua

Dominica	Panama
Dominican Republic	St. Kitts-Nevis
El Salvador	St. Lucia
Grenada	St. Vincent and the Grenadines
Guatemala	Trinidad and Tobago

(2) "Caribbean Basin country end product"--

(i) Means an article that--

(A) Is wholly the growth, product, or manufacture of a Caribbean Basin country; or

(B) In the case of an article that consists in whole or in part of materials from another country or instrumentality, been substantially transformed in a Caribbean Basin country into a new and different article of commerce with a name, character, or use distinct from that of the article or articles from which it was so transformed. The term refers to a product offered for purchase under a supply contract, but for purposes of calculating the value of the end product includes services (except transportation services) incidental to its supply, provided that the value of those incidental services does not exceed the value of the product itself.

(ii) Excludes products, other than petroleum and any product derived from petroleum, that are not granted duty-free treatment under the Caribbean Basin Economic Recovery Act (19 U.S.C. 2703(b)). These exclusions presently consist of--

(A) Textiles and apparel articles that are subject to textile agreements;

(B) Footwear, handbags, luggage, flat goods, work gloves, and leather wearing apparel not designated as eligible articles for the purpose of the Generalized System of Preferences under Title V of the Trade Act of 1974;

(C) Tuna, prepared or preserved in any manner in airtight containers; and

(D) Watches and watch parts (including cases, bracelets, and straps) of whatever type, including, but not limited to, mechanical, quartz digital, or quartz analog, if such watches or watch parts contain any material that is the product of any country to which Harmonized Tariff Schedule column 2 rates of duty apply.

(3) "Components," "domestic end product," "end product," "nonqualifying country," "qualifying country," and "qualifying country end product" have the meanings given in the Buy American Act and Balance of Payments Program clause of this contract.

(4) "Designated country" means:

Aruba	Kiribati
Austria	Lesotho
Bangladesh	Liechtenstein
Belgium	Luxembourg
Benin	Malawi
Bhutan	Maldives
Botswana	Mali
Burkina Faso	Mozambique
Burundi	Nepal
Canada	Netherlands
Cape Verde	Niger
Central African Republic	Norway
Chad	Portugal
Comoros	Republic of Korea
Denmark	Rwanda
Djibouti	Sao Tome and Principe

Equatorial Guinea	Sierra Leone
Finland	Somalia
France	Spain
Gambia	Sweden
Germany	Switzerland
Greece	Tanzania U.R.
Guinea	Togo
Guinea-Bissau	Tuvalu
Haiti	Uganda
Hong Kong	United Kingdom
Ireland	Vanuatu
Israel	Western Samoa
Italy	Yemen
Japan	

(5) "Designated country end product" means an article that--

(i) Is wholly the growth, product, or manufacture of the designated country; or

(ii) In the case of an article which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a designated country into a new and different article of commerce with a name, character, or use distinct from that of the article or articles from which it was so transformed. The term refers to a product offered for purchase under a supply contract, but for purposes of calculating the value of the end product includes services (except transportation services) incidental to its supply, provided that the value of those incidental services does not exceed the value of the product itself.

(6) "NAFTA country end product" means an article that--

(i) Is wholly the growth, product, or manufacture of the NAFTA country; or

(ii) In the case of an article which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a NAFTA country into a new and different article of commerce with a name, character, or use distinct from that of the article or articles from which it was so transformed. The term refers to a product offered for purchase under a supply contract, but for purposes of calculating the value of the end product includes services (except transportation services) incidental to its supply, provided that the value of those incidental services does not exceed the value of the product itself.

(7) "Nondesignated country end product" means any end product which is not a U.S. made end product or a designated country end product.

(8) "North American Free Trade Agreement (NAFTA) country" means Canada or Mexico.

(9) "United States" means the United States, its possessions, Puerto Rico, and any other place subject to its jurisdiction, but does not include leased bases or trust territories.

(10) "U.S. made end product" means an article that--

(i) Is wholly the growth, product or manufacture of the United States, or

(ii) In the case of an article which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in the United States into a new and distinct article of commerce with a name, character, or use distinct from that of the article or articles from which it was so transformed.

(b) Unless otherwise specified, the Trade Agreements Act of 1979 (19 U.S.C. 2501 et seq.), the North American Free Trade Agreement

Implementation Act of 1993 (19 U.S.C. 3301 note), and the Caribbean Basin Initiative apply to all items in the Schedule.

(c)(1) The Contractor agrees to deliver under this contract only domestic end products unless, in its offer, it specified delivery of U.S. made, qualifying country, designated country, Caribbean Basin country, NAFTA country, or other nondesignated country end products in the Buy American Act--Trade Agreements--Balance of Payments Program Certificate provision of the solicitation.

(2) The Contractor may not supply a nondesignated country end product unless--

(i) It is a qualifying country end product, Caribbean Basin country end product, or a NAFTA country end product;

(ii) The Contracting Officer has determined that offers of U.S. made end products or qualifying, designated, NAFTA, or Caribbean Basin Country end products from responsive, responsible offerors are either not received or are insufficient to fill the Government's requirements; or

(iii) A national interest waiver has been granted under section 302 of the Trade Agreements Act of 1979 (see FAR 25.402(c)).

(d) The offered price of end products listed and certified under paragraphs (c)(2)(i) and (vi) of the Buy American Act--Trade Agreements--Balance of Payments Program Certificate provision of the solicitation must include all applicable duty. The offered price of qualifying country end products, designated country end products, NAFTA country end products, and Caribbean Basin country end products for line items subject to the Trade Agreements Act or the North American Free Trade Agreement Implementation Act, should not include custom fees or duty.

(End of clause)

59 52.225-7016 RESTRICTION ON ACQUISITION OF BALL AND ROLLER BEARINGS
(FEB 1998)

(a) Definitions.

As used in this clause--

(1) "Bearing components" means the bearing element, retainer, inner race, or outer race.

(2) "Miniature and instrument ball bearings" means all rolling contact ball bearings with a basic outside diameter (exclusive of flange diameters) of 30 millimeters or less, regardless of material, tolerance, performance, or quality characteristics.

(b) The Contractor agrees that, except as provided in paragraph (c) of this clause, all ball and roller bearings and ball and roller bearing components (including miniature and instrument ball bearings) delivered under this contract, either as end items or components of end items, shall be wholly manufactured in the United States or Canada. Unless otherwise specified, raw materials, such as performed bar, tube, or rod stock and lubricants, need not be mined or produced in the United States or Canada.

(c)(1) The restriction in paragraph (b) of this clause does not apply to the extent that the end items or components containing ball or roller bearings are commercial items.

(2) The commercial item exception in paragraph (c)(1) of this clause does not include items designed or developed under a Government contract or contracts where the end item is bearings and bearing components.

(d) The restriction in paragraph (b) of this clause may be waived upon request from the Contractor in accordance with subsection 225.7019-3 of the Defense Federal Acquisition Regulation Supplement. If the restriction is

waived for miniature and instrument ball bearings, the Contractor agrees to acquire a like quantity and type of domestic manufacture for nongovernmental use.

(e) The Contractor agrees to retain records showing compliance with this restriction until 3 years after final payment and to make records available upon request of the Contracting Office.

(f) The Contractor agrees to insert this clause, including this paragraph (f), in every subcontract and purchase order issued in performance of this contract, unless items acquired are--

- (1) Commercial items other than ball or roller bearings; or
- (2) Items that do not contain ball or roller bearings.

(End of clause)

60 52.225-7030 RESTRICTION ON ACQUISITION OF CARBON, ALLOY, AND ARMOR
STEEL PLATE (OCT 1992)

The Contractor agrees that all carbon, alloy, and armor steel plate in Federal supply class 9515, or described by American Society for Testing Materials (ASTM) or American Iron and Steel Institute (AISI) specifications, furnished as a deliverable under this contract, or purchased by the contractor as a raw material, for use in a Government-owned facility or a facility under the control of the Department of Defense, shall be melted and rolled in the United States or Canada.

(End of clause)

61 52.225-7031 SECONDARY ARAB BOYCOTT OF ISRAEL (JUN 1992)

(a) Definitions.

As used in this clause--

(1) "Foreign person" means any person other than a United States person as defined in section 16(2) of the Export Administration Act of 1979 (50 U.S.C. App. Sec 2415).

(2) "United States person" is defined in section 16(2) of the Export Administration Act of 1979 and means any United States resident or national (other than an individual resident outside the United States and employed by other than a United States person), any domestic concern (including any permanent domestic establishment of any foreign concern), and any foreign subsidiary or affiliate (including any permanent foreign establishment) of any domestic concern which is controlled in fact by such domestic concern, as determined under regulations of the President.

(b) Certification.

By submitting this offer, the Offeror, if a foreign person, company or entity, certifies that it--

- (1) Does not comply with the Secondary Arab Boycott of Israel; and
- (2) Is not taking or knowingly agreeing to take any action, with respect to the Secondary Boycott of Israel by Arab countries, which 50 U.S.C. App. Sec 2407(a) prohibits a United States person from taking.

(End of clause)

62 52.226-1 UTILIZATION OF INDIAN ORGANIZATIONS AND INDIAN-OWNED
ECONOMIC ENTERPRISES (SEP 1996)

(a) For Department of Defense contracts, this clause applies only if the contract includes a subcontracting plan incorporated under the terms of the clause at 52.219-9, Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan. It does not apply to contracts awarded based on a subcontracting plan submitted and approved under paragraph (g) of the clause at 52.219

(b) Definitions. As used in this clause:

"Indian" means any person who is a member of any Indian tribe, band, group, pueblo or community which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs (BIA) in accordance with 25 U.S.C. 1452(c) and any "Native" as defined in the Alaska Native Claims Settlement Act (43 U.S.C. 1601).

"Indian organization" means the governing body of any Indian tribe or entity established or recognized by the governing body of an Indian tribe for the purposes of 25 U.S.C., Chapter 17.

"Indian-owned economic enterprise" means any Indian-owned (as determined by the Secretary of the Interior) commercial, industrial, or business activity established or organized for the purpose of profit, provided that Indian ownership shall constitute not less than 51 percent of the enterprise.

"Indian tribe" means any Indian tribe, band, group, pueblo or community, including native villages and native groups (including corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, which is recognized by the Federal Government as eligible for services from BIA in accordance with 25 U.S.C. 1542(c).

"Interested party" means a prime contractor or an actual or prospective offeror whose direct economic interest would be affected by the award of a subcontract or by the failure to award a subcontract.

(c) The Contractor agrees to use its best efforts to give Indian organizations and Indian-owned economic enterprises (25 U.S.C. 1544) the maximum practicable opportunity to participate in the subcontracts it awards to the fullest extent consistent with efficient performance of its contract.

(1) The Contracting Officer and the Contractor, acting in good faith, may rely on the self-certification of an Indian organization or Indian-owned economic enterprise as to its eligibility, unless an interested party challenges its status or the Contracting Officer has independent reason to question that status. In the event of a challenge to the self-certification of a subcontractor, the Contracting Officer shall refer the matter to the U.S. Department of the Interior, Bureau of Indian Affairs (BIA), Attn: Chief, Division of Contracting and Grants Administration, 1849 C Street, NW, MS-334A-SIB, Washington, DC 20245. The BIA will determine the eligibility and notify the Contracting Officer. The 5 percent incentive payment will not be made within 50 working days of subcontract award or while a challenge is pending. If a subcontractor is determined to be an ineligible participant, no incentive payment will be made under the Indian Incentive Program.

(2) The Contractor may request an adjustment under the Indian Incentive Program to the following:

- (i) The estimated cost of a cost-type contract.
- (ii) The target cost of a cost-plus-incentive-fee prime contract.
- (iii) The target cost and ceiling price of a fixed-price incentive prime contract.

(iv) The price of a firm-fixed-price prime contract.

(3) The amount of the equitable adjustment to the prime contract shall be 5 percent of the estimated cost, target cost or firm-fixed-price included in the subcontract initially awarded to the Indian organization or Indian-owned economic enterprise.

(4) The Contractor has the burden of proving the amount claimed and must assert its request for an adjustment prior to completion of contract performance.

(d) The Contracting Officer, subject to the terms and conditions of the contract and the availability of funds, shall authorize an incentive payment of 5 percent of the amount paid to the subcontractor. Contracting Officers shall seek funding in accordance with agency procedures. The Contracting Officer's decision is final and not subject to the Disputes clause of this contract.

(End of clause)

63 52.227-1 AUTHORIZATION AND CONSENT (JUL 1995)

(a) The Government authorizes and consents to all use and manufacture, in performing this contract or any subcontract at any tier, of any invention described in and covered by a United States patent (1) embodied in the structure or composition of any article the delivery of which is accepted by the Government under this contract or (2) used in machinery, tools, or methods whose use necessarily results from compliance by the Contractor or a subcontractor with (i) specifications or written provisions forming a part of this contract or (ii) specific written instructions given by the Contracting Officer directing the manner of performance. The entire liability to the Government for infringement of a patent of the United States shall be determined solely by the provisions of the indemnity clause, if any, included in this contract or any subcontract hereunder (including any lower-tier subcontract), and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.

(b) The Contractor agrees to include, and require inclusion of, this clause, suitably modified to identify the parties, in all subcontracts at any tier for supplies or services (including construction, architect-engineer services, and materials, supplies, models, samples, and design or testing services expected to exceed the simplified acquisition threshold); however, omission of this clause from any subcontract, including those at or below the simplified acquisition threshold, does not affect this authorization and consent.

(End of clause)

64 52.227-2 NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT (AUG 1996)

(a) The Contractor shall report to the Contracting Officer, promptly and in reasonable written detail, each notice or claim of patent or copyright infringement based on the performance of this contract of which the Contractor has knowledge.

(b) In the event of any claim or suit against the Government on account of any alleged patent or copyright infringement arising out of the performance of this contract or out of the use of any supplies furnished or work or services performed under this contract, the Contractor shall furnish to the Government, when requested by the Contracting Officer, all evidence

and information in possession of the Contractor pertaining to such suit or claim. Such evidence and information shall be furnished at the expense of the Government except where the Contractor has agreed to indemnify the Government.

(c) The Contractor agrees to include, and require inclusion of, this clause in all subcontracts at any tier for supplies or services (including construction and architect-engineer subcontracts and those for material, supplies, models, samples, or design or testing services) expected to exceed the simplified acquisition threshold at FAR 2.101.

(End of clause)

65 52.227-4 PATENT INDEMNITY--CONSTRUCTION CONTRACTS (APR 1984)

Except as otherwise provided, the Contractor agrees to indemnify the Government and its officers, agents, and employees against liability, including costs and expenses, for infringement upon any United States patent (except a patent issued upon an application that is now or may hereafter be withheld from issue pursuant to a Secrecy Order under 35 U.S.C. 181) arising out of performing this contract or out of the use or disposal by or for the account of the Government of supplies furnished or work performed under this contract.

(End of clause)

(R 7-602.16 1964 JUN)

66 52.227-13 PATENT RIGHTS--ACQUISITION BY THE GOVERNMENT (JAN 1997)

(a) Definitions. "Invention," as used in this clause, means any invention or discovery which is or may be patentable or otherwise protectable under Title 35 of the United States Code or any novel variety of plant that is or may be protectable under the Plant Variety Protection Act (7 U.S.C. 2321, et seq.).

"Practical application," as used in this clause, means to manufacture, in the case of a composition or product; to practice, in the case of a process or method; or to operate, in the case of a machine or system; and, in each case, under such conditions as to establish that the invention is being utilized and that its benefits are, to the extent permitted by law or Government regulations, available to the public on reasonable terms.

"Subject invention," as used in this clause, means any invention of the Contractor conceived or first actually reduced to practice in the performance of work under this contract; provided, that in the case of a variety of plant, the date of determination (as defined in section 41(d) of the Plant Variety Protection Act, 7 U.S.C. 2401(d)) must also occur during the period of contract performance.

(b) Allocations of principal rights. (1) Assignment to the Government. The Contractor agrees to assign to the Government the entire right, title, and interest throughout the world in and to each subject invention, except to the extent that rights are retained by the Contractor under subparagraph (b)(2) and paragraph (d) below.

(2) Greater rights determinations. (i) The Contractor, or an employee-inventor after consultation with the Contractor, may retain greater rights than the nonexclusive license provided in paragraph (d) below, in accordance with the procedures of paragraph 27.304-1(a) of the Federal Acquisition Regulation (FAR). A request for a determination of whether the Contractor or the employee-inventor is entitled to retain such greater rights must be submitted to the Head of the Contracting

Agency or designee at the time of the first disclosure of the invention pursuant to subparagraph (e)(2) below, or not later than 8 months thereafter, unless a longer period is authorized in writing by the Contracting Officer for good cause shown in writing by the Contractor. Each determination of greater rights under this contract normally shall be subject to paragraph (c) below, and to the reservations and conditions deemed to be appropriate by the Head of the Contracting Agency or designee.

(ii) Upon request, the Contractor shall provide the filing date, serial number and title, a copy of the patent application (including an English-language version if filed in a language other than English), and patent number and issue date for any subject invention in any country for which the Contractor has retained title.

(iii) Upon request, the Contractor shall furnish the Government an irrevocable power to inspect and make copies of the patent application file.

(c) Minimum rights acquired by the Government. (1) With respect to each subject invention to which the Contractor retains principal or exclusive rights, the Contractor agrees as follows:

(i) The Contractor hereby grants to the Government a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced each subject invention throughout the world by or on behalf of the Government of the United States (including any Government agency).

(ii) The Contractor agrees that with respect to any subject invention in which it has acquired title, the Federal agency has the right in accordance with the procedures in FAR 27.304-1(g) to require the Contractor, an assignee, or exclusive licensee of a subject invention to grant a nonexclusive, partially exclusive, or exclusive license in any field of use to a responsible applicant or applicants, upon terms that are reasonable under the circumstances, and if the Contractor, assignee, or exclusive licensee refuses such a request, the Federal agency has the right to grant such a license itself if the Federal agency determines that--

(A) Such action is necessary because the Contractor or assignee has not taken, or is not expected to take within a reasonable time, effective steps to achieve practical application of the subject invention in such field of use;

(B) Such action is necessary to alleviate health or safety needs which are not reasonably satisfied by the Contractor, assignee, or their licensees;

(C) Such action is necessary to meet requirements for public use specified by Federal regulations and such requirements are not reasonably satisfied by the Contractor, assignee, or licensees; or

(D) Such action is necessary because the agreement required by paragraph (i) of this clause has neither been obtained nor waived or because a licensee of the exclusive right to use or sell any subject invention in the United States is in breach of such agreement.

(iii) The Contractor agrees to submit on request periodic reports no more frequently than annually on the utilization of a subject invention or efforts at obtaining such utilization of a subject invention or on efforts at obtaining such utilization that are being made by the Contractor or its licensees or assignees. Such reports shall include information regarding the status of development, date of first commercial sale or use, gross royalties received by the Contractor, and such other data and information as the agency may reasonably specify. The Contractor also agrees to provide additional

reports as may be requested by the agency in connection with any march-in proceedings undertaken by the agency in accordance with subdivision (ii) above. To the extent data or information supplied under this section is considered by the Contractor, its licensee, or assignee to be privileged and confidential and is so marked, the agency agrees that, to the extent permitted by law, it will not disclose such information to persons outside the Government.

(iv) The Contractor agrees, when licensing a subject invention, to arrange to avoid royalty charges on acquisitions involving Government funds, including funds derived through a Military Assistance Program of the Government or otherwise derived through the Government, to refund any amounts received as royalty charges on a subject invention in acquisitions for, or on behalf of, the Government, and to provide for such refund in any instrument transferring rights in the invention to any party.

(v) The Contractor agrees to provide for the Government's paid-up license pursuant to subdivision (i) above in any instrument transferring rights in a subject invention and to provide for the granting of licenses as required by subdivision (ii) above, and for the reporting of utilization information as required by subdivision (iii) above, whenever the instrument transfers principal or exclusive rights in a subject invention.

(2) Nothing contained in this paragraph (c) shall be deemed to grant to the Government any rights with respect to any invention other than a subject invention.

(d) Minimum rights to the Contractor. (1) The Contractor is hereby granted a revocable nonexclusive, royalty-free license in each patent application filed in any country on a subject invention and any resulting patent in which the Government obtains title, unless the Contractor fails to disclose the subject invention within the times specified in subparagraph (e)(2) below. The Contractor's license extends to its domestic subsidiaries and affiliates, if any, within the corporate structure of which the Contractor is a part and includes the right to grant sublicenses of the same scope to the extent the Contractor was legally obligated to do so at the time the contract was awarded. The license is transferable only with the approval of the funding Federal agency except when transferred to the successor of that part of the Contractor's business to which the invention pertains.

(2) The Contractor's domestic license may be revoked or modified by the funding Federal agency to the extent necessary to achieve expeditious practical application of the subject invention pursuant to an application for an exclusive license submitted in accordance with applicable provisions in 37 Part 404 and agency licensing regulations. This license will not be revoked in that field of use or the geographical areas in which the Contractor has achieved practical applications and continues to make the benefits of the invention reasonably accessible to the public. The license in any foreign country may be revoked or modified at the discretion of the funding Federal agency to the extent the Contractor, its licensees, or its domestic subsidiaries or affiliates have failed to achieve practical application in that foreign country.

(3) Before revocation or modification of the license, the funding Federal agency will furnish the Contractor a written notice of its intention to revoke or modify the license, and the Contractor will be allowed 30 days (or such other time as may be authorized by the funding Federal agency for good cause shown by the Contractor) after the notice to show cause why the license should not be revoked or modified. The

Contractor has the right to appeal, in accordance with applicable agency licensing regulations and 37 CFR 404 concerning the licensing of Government-owned inventions, any decision concerning the revocation or modification of its license.

(4) When the Government has the right to receive title, and does not elect to secure a patent in a foreign country, the Contractor may elect to retain such rights in any foreign country in which the Government elects not to secure a patent, subject to the Government's rights in subparagraph (c)(1) of this clause.

(e) Invention identification, disclosures, and reports. (1) The Contractor shall establish and maintain active and effective procedures to assure that subject inventions are promptly identified and disclosed to Contractor personnel responsible for patent matters within 6 months of conception and/or first actual reduction to practice, whichever occurs first in the performance of work under this contract. These procedures shall include the maintenance of laboratory notebooks or equivalent records and other records as are reasonably necessary to document the conception and/or the first actual reduction to practice of subject inventions, and records that show that the procedures for identifying and disclosing the inventions are followed. Upon request, the Contractor shall furnish the Contracting Officer a description of such procedures for evaluation and for determination as to their effectiveness.

(2) The Contractor shall disclose each subject invention to the Contracting Officer within 2 months after the inventor discloses it in writing to Contractor personnel responsible for patent matters or, if earlier, within 6 months after the Contractor becomes aware that a subject invention has been made, but in any event before any on sale, public use, or publication of such invention known to the Contractor. The disclosure to the agency shall be in the form of a written report and shall identify the contract under which the invention was made and the inventor(s). It shall be sufficiently complete in technical detail to convey a clear understanding, to the extent known at the time of the disclosure, of the nature, purpose, operation, and physical, chemical, biological, or electrical characteristics of the invention. The disclosure shall also identify any publication, on sale, or public use of the invention and whether a manuscript describing the invention has been submitted for publication and, if so, whether it has been accepted for publication at the time of disclosure. In addition, after disclosure to the agency, the Contractor shall promptly notify the agency of the acceptance of any manuscript describing the invention for publication or of any on sale or public use planned by the Contractor.

(3) The Contractor shall furnish the Contracting Officer the following:

(i) Interim reports every 12 months (or such longer period as may be specified by the Contracting Officer) from the date of the contract, listing subject inventions during that period, and stating that all subject inventions have been disclosed (or that there are not such inventions) and that the procedures required by subparagraph (e)(1) above have been followed.

(ii) A final report, within 3 months after completion of the contracted work, listing all subject inventions or stating that there were no such inventions, and listing all subcontracts at any tier containing a patent rights clause or certifying that there were no such subcontracts.

(4) The Contractor agrees to require, by written agreement, its employees, other than clerical and nontechnical employees, to disclose promptly in writing to personnel identified as responsible for the administration of patent matters and in a format suggested by the

Contractor each subject invention made under contract in order that the Contractor can comply with the disclosure provisions of paragraph (c) above, and to execute all papers necessary to file patent applications on subject inventions and to establish the Government's rights in the subject inventions. This disclosure format should require, as a minimum, the information required by subparagraph (2) above.

(5) The Contractor agrees subject to FAR 27.302(i) that the Government may duplicate and disclose subject invention disclosures and all other reports and papers furnished or required to be furnished pursuant to this clause.

(f) Examination of records relating to inventions. (1) The Contracting Officer or any authorized representative shall, until 3 years after final payment under this contract, have the right to examine any books (including laboratory notebooks), records, and documents of the Contractor relating to the conception or first actual reduction to practice of inventions in the same field of technology as the work under this contract to determine whether--

- (i) Any such inventions are subject inventions;
- (ii) The Contractor has established and maintains the procedures required by subparagraphs (e)(1) and (4) of this clause; and
- (iii) The Contractor and its inventors have complied with the procedures.

(2) If the Contracting Officer learns of an unreported Contractor invention which the Contracting Officer believes may be a subject invention, the Contractor may be required to disclose the invention to the agency for a determination of ownership rights.

(3) Any examination of records under this paragraph will be subject to appropriate conditions to protect the confidentiality of the information involved.

(g) Withholding of payment (this paragraph does not apply to subcontracts). (1) Any time before final payment under this contract, the Contracting Officer may, in the Government's interest, withhold payment until a reserve not exceeding \$50,000 or 5 percent of the amount of this contract, whichever is less, shall have been set aside if, in the Contracting Officer's opinion, the Contractor fails to--

- (i) Establish, maintain, and follow effective procedures for identifying and disclosing subject inventions pursuant to subparagraph (e)(1) above;
- (ii) Disclose any subject invention pursuant to subparagraph (e)(2) above;
- (iii) Deliver acceptable interim reports pursuant to subdivision (e)(3)(i) above; or
- (iv) Provide the information regarding subcontracts pursuant to subparagraph (h)(4) below.

(2) Such reserve or balance shall be withheld until the Contracting Officer has determined that the Contractor has rectified whatever deficiencies exist and has delivered all reports, disclosures, and other information required by this clause.

(3) Final payment under this contract shall not be made before the Contractor delivers to the Contracting Officer all disclosures of subject inventions required by subparagraph (e)(2) above, and acceptable final report pursuant to subdivision (e)(3)(ii) above, and all past due confirmatory instruments.

(4) The Contracting Officer may decrease or increase the sums withheld up to the maximum authorized above. No amount shall be withheld under this paragraph while the amount specified by this paragraph is being withheld under other provisions of the contract. The withholding of any

amount or the subsequent payment thereof shall not be construed as a waiver of any Government rights.

(h) Subcontracts. (1) The Contractor shall include this clause (suitably modified to identify the parties) in all subcontracts, regardless of tier, for experimental, developmental, or research work. The subcontractor shall retain all rights provided for the Contractor in this clause, and the Contractor shall not, as part of the consideration for awarding the subcontract, obtain rights in the subcontractor's subject inventions.

(2) In the event of a refusal by a prospective subcontractor to accept such a clause the Contractor--

(i) Shall promptly submit a written notice to the Contracting Officer setting forth the subcontractor's reasons for such refusal and other pertinent information that may expedite disposition of the matter; and

(ii) Shall not proceed with such subcontract without the written authorization of the Contracting Officer.

(3) In the case of subcontracts at any tier, the agency, subcontractor, and Contractor agree that the mutual obligations of the parties created by this clause constitute a contract between the subcontractor and the Federal agency with respect to those matters covered by this clause.

(4) The Contractor shall promptly notify the Contracting Officer in writing upon the award of any subcontract at any tier containing a patent rights clause by identifying the subcontractor, the applicable patent rights clause, the work to be performed under the subcontract, and the dates of award and estimated completion. Upon request of the Contracting Officer, the Contractor shall furnish a copy of such subcontract, and, no more frequently than annually, a listing of the subcontracts that have been awarded.

(i) Preference for United States industry. Unless provided otherwise, no Contractor that receives title to any subject invention and no assignee of any such Contractor shall grant to any person the exclusive right to use or sell any subject invention in the United States unless such person agrees that any products embodying the subject invention will be manufactured substantially in the United States. However, in individual cases, the requirement may be waived by the Government upon a showing by the Contractor or assignee that reasonable but unsuccessful efforts have been made to grant licenses on similar terms to potential licensees that would be likely to manufacture substantially in the United States or that under the circumstances domestic manufacture is not commercially feasible.

(End of clause)

67 52.227-7033 RIGHTS IN SHOP DRAWINGS (APR 1966)

(a) Shop drawings for construction means drawings, submitted to the Government by the Construction Contractor, subcontractor or any lower-tier subcontractor pursuant to a construction contract, showing in detail (i) the proposed fabrication and assembly of structural elements and (ii) the installation (i.e., form, fit, and attachment details) of materials or equipment. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(b) This clause, including this paragraph (b), shall be included in all subcontracts hereunder at any tier.

(End of clause)

68 52.228-2 ADDITIONAL BOND SECURITY (OCT 1997)

The Contractor shall promptly furnish additional security required to protect the Government and persons supplying labor or materials under this contract if--

(a) Any surety upon any bond, or issuing financial institution for other security, furnished with this contract becomes unacceptable to the Government;

(b) Any surety fails to furnish reports on its financial condition as required by the Government;

(c) The contract price is increased so that the penal sum of any bond becomes inadequate in the opinion of the Contracting Officer; or

(d) An irrevocable letter of credit (ILC) used as security will expire before the end of the period of required security. If the Contractor does not furnish an acceptable extension or replacement ILC, or other acceptable substitute, at least 30 days before an ILC's scheduled expiration, the Contracting officer has the right to immediately draw on the ILC.

(End of clause)

69 52.228-5 INSURANCE--WORK ON A GOVERNMENT INSTALLATION (JAN 1997)

(a) The Contractor shall, at its own expense, provide and maintain during the entire performance of this contract, at least the kinds and minimum amounts of insurance required in the Schedule or elsewhere in the contract.

(b) Before commencing work under this contract, the Contractor shall notify the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective (1) for such period as the laws of the State in which this contract is to be performed prescribe, or (2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

(c) The Contractor shall insert the substance of this clause, including this paragraph (c), in subcontracts under this contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

(End of clause)

70 52.228-11 PLEDGES OF ASSETS (FEB 1992)

(a) Offerors shall obtain from each person acting as an individual surety on a bid guarantee, a performance bond, or a payment bond--

(1) Pledge of assets; and

(2) Standard Form 28, Affidavit of Individual Surety.

(b) Pledges of assets from each person acting as an individual surety shall be in the form of--

(1) Evidence of an escrow account containing cash, certificates of deposit, commercial or Government securities, or other assets described in FAR 28.203-2 (except see 28.203-2(b)(2) with respect to Government securities held in book entry form) and/or;

(2) A recorded lien on real estate. The offeror will be required to provide--

(i) Evidence of title in the form of a certificate of title prepared by a title insurance company approved by the United States Department of Justice. This title evidence must show fee simple title vested in the surety along with any concurrent owners; whether any real estate taxes are due and payable; and any recorded encumbrances against the property, including the lien filed in favor of the Government as required by FAR 28.203-3(d);

(ii) Evidence of the amount due under any encumbrance shown in the evidence of title;

(iii) A copy of the current real estate tax assessment of the property or a current appraisal dated no earlier than 6 months prior to the date of the bond, prepared by a professional appraiser who certifies that the appraisal has been conducted in accordance with the generally accepted appraisal standards as reflected in the Uniform Standards of Professional Appraisal Practice, as promulgated by the Appraisal Foundation.

(End of clause)

71 52.228-15 PERFORMANCE AND PAYMENT BONDS--CONSTRUCTION (SEP 1996)

(a) Definitions. As used in this clause--

Contract price means the award price of the contract or, for requirements contracts, the price payable for the estimated quantity; or for indefinite-delivery type contracts, the price payable for the specified minimum quantity.

(b) Unless the resulting contract price is \$100,000 or less, the successful offeror shall be required to furnish performance and payment bonds to the Contracting Officer as follows:

(1) Performance Bonds (Standard Form 25):

(i) The penal amount of performance bonds shall be 100 percent of the original contract price.

(ii) The Government may require additional performance bond protection when the contract price is increased. The increase in protection shall generally equal 100 percent of the increase in contract price.

(iii) The Government may secure additional protection by directing the Contractor to increase the penal amount of the existing bond or to obtain an additional bond.

(2) Payment Bonds (Standard Form 25-A):

(i) The penal amount of payment bonds shall equal--

(A) 50 percent of the contract price if the contract price is not more than \$1 million;

(B) 40 percent of the contract price if the contract price is more than \$1 million but not more than \$5 million; or

(C) \$2.5 million if the contract price is more than \$5 million.

(ii) If the original contract price is \$5 million or less, the Government may require additional protection if the contract price is increased. The penal amount of the total protection shall meet the requirement of subparagraph (b)(2)(i) of this clause.

(iii) The Government may secure additional protection by directing the Contractor to increase the penal sum of the existing bond or to obtain an additional bond.

(c) The Contractor shall furnish all executed bonds, including any

necessary reinsurance agreements, to the Contracting Officer, within the time period specified in the Bid Guarantee provision of the solicitation, or otherwise specified by the Contracting Officer, but in any event, before starting work.

(d) The bonds shall be in the form of firm commitment, supported by corporate sureties whose names appear on the list contained in Treasury Department Circular 570, individual sureties, or by other acceptable security such as postal money order, certified check, cashier's check, irrevocable letter of credit, or, in accordance with Treasury Department regulations, certain bonds or notes of the United States. Treasury Circular 570 is published in the Federal Register, or may be obtained from the U.S. Department of Treasury, Financial Management Service, Surety Bond Branch, 401 14th Street, NW., 2nd Floor, West Wing, Washington, DC 20227.

(End of clause)

72 52.229-3 FEDERAL, STATE, AND LOCAL TAXES (JAN 1991)

(a) "Contract date," as used in this clause, means the date set for bid opening or, if this is a negotiated contract or a modification, the effective date of this contract or modification.

"All applicable Federal, State, and local taxes and duties," as used in this clause, means all taxes and duties, in effect on the contract date, that the taxing authority is imposing and collecting on the transactions or property covered by this contract.

"After-imposed Federal tax," as used in this clause, means any new or increased Federal excise tax or duty, or tax that was exempted or excluded on the contract date but whose exemption was later revoked or reduced during the contract period, on the transactions or property covered by this contract that the Contractor is required to pay or bear as the result of legislative, judicial, or administrative action taking effect after the contract date. It does not include social security tax or other employment taxes.

"After-relieved Federal tax," as used in this clause, means any amount of Federal excise tax or duty, except social security or other employment taxes, that would otherwise have been payable on the transactions or property covered by this contract, but which the Contractor is not required to pay or bear, or for which the Contractor obtains a refund or drawback, as the result of legislative, judicial, or administrative action taking effect after the contract date.

(b) The contract price includes all applicable Federal, State, and local taxes and duties.

(c) The contract price shall be increased by the amount of any after-imposed Federal tax, provided the Contractor warrants in writing that no amount for such newly imposed Federal excise tax or duty or rate increase was included in the contract price, as a contingency reserve or otherwise.

(d) The contract price shall be decreased by the amount of any after-relieved Federal tax.

(e) The contract price shall be decreased by the amount of any Federal excise tax or duty, except social security or other employment taxes, that the Contractor is required to pay or bear, or does not obtain a refund of, through the Contractor's fault, negligence, or failure to follow instructions of the Contracting Officer.

(f) No adjustment shall be made in the contract price under this clause unless the amount of the adjustment exceeds \$250.

(g) The Contractor shall promptly notify the Contracting Officer of all matters relating to any Federal excise tax or duty that reasonably may be

expected to result in either an increase or decrease in the contract price and shall take appropriate action as the Contracting Officer directs.

(h) The Government shall, without liability, furnish evidence appropriate to establish exemption from any Federal, State, or local tax when the Contractor requests such evidence and a reasonable basis exists to sustain the exemption.

(End of clause)

73 52.229-5 TAXES--CONTRACTS PERFORMED IN U.S. POSSESSIONS OR PUERTO RICO (APR1984)

The term "local taxes," as used in the Federal, State, and local taxes clause of this contract, includes taxes imposed by a possession of the United States or by Puerto Rico.

(End of clause)

(AV 7-103.10(c) 1963 NOV)

(AV 1-11.401-3(a))

74 52.232-5 PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS (MAY 1997)

(a) Payment of price. The Government shall pay the Contractor the contract price as provided in this contract.

(b) Progress payments. The Government shall make progress payments monthly as the work proceeds, or at more frequent intervals as determined by the Contracting Officer, on estimates of work accomplished which meets the standards of quality established under the contract, as approved by the Contracting Officer.

(1) The Contractor's request for progress payments shall include the following substantiation:

(i) An itemization of the amounts requested, related to the various elements of work required by the contract covered by the payment requested.

(ii) A listing of the amount included for work performed by each subcontractor under the contract.

(iii) A listing of the total amount of each subcontract under the contract.

(iv) A listing of the amounts previously paid to each such subcontractor under the contract.

(v) Additional supporting data in a form and detail required by the Contracting Officer.

(2) In the preparation of estimates, the Contracting Officer may authorize material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the Contractor at locations other than the site also may be taken into consideration if--

(i) Consideration is specifically authorized by this contract; and

(ii) The Contractor furnishes satisfactory evidence that it has acquired title to such material and that the material will be used to perform this contract.

(c) Contractor certification. Along with each request for progress payments, the Contractor shall furnish the following certification, or payment shall not be made: (However, if the Contractor elects to delete paragraph (c)(4) from the certification, the certification is still acceptable.)

I hereby certify, to the best of my knowledge and belief, that--

(1) The amounts requested are only for performance in accordance with the specifications, terms, and conditions of the contract;

(2) Payments to subcontractors and suppliers have been made from previous payments received under the contract, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements and the requirements of chapter 39 of Title 31, United States Code;

(3) This request for progress payments does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract; and

(4) This certification is not to be construed as final acceptance of a subcontractor's performance.

(Name)

(Title)

(Date)

(d) Refund of unearned amounts. If the Contractor, after making a certified request for progress payments, discovers that a portion or all of such request constitutes a payment for performance by the Contractor that fails to conform to the specifications, terms, and conditions of this contract (hereinafter referred to as the "unearned amount"), the Contractor shall--

(1) Notify the Contracting Officer of such performance deficiency; and

(2) Be obligated to pay the Government an amount (computed by the Contracting Officer in the manner provided in paragraph (j) of this clause) equal to interest on the unearned amount from the 8th day after the date of receipt of the unearned amount until--

(i) The date the Contractor notifies the Contracting Officer that the performance deficiency has been corrected; or

(ii) The date the Contractor reduces the amount of any subsequent certified request for progress payments by an amount equal to the unearned amount.

(e) Retainage. If the Contracting Officer finds that satisfactory progress was achieved during any period for which a progress payment is to be made, the Contracting Officer shall authorize payment to be made in full. However, if satisfactory progress has not been made, the Contracting Officer may retain a maximum of 10 percent of the amount of the payment until satisfactory progress is achieved. When the work is substantially complete, the Contracting Officer may retain from previously withheld funds and future progress payments that amount the Contracting Officer considers adequate for protection of the Government and shall release to the Contractor all the remaining withheld funds. Also, on completion and acceptance of each separate building, public work, or other division of the contract, for which the price is stated separately in the contract, payment shall be made for the completed work without retention of a percentage.

(f) Title, liability, and reservation of rights. All material and work covered by progress payments made shall, at the time of payment, become the sole property of the Government, but this shall not be construed as--

(1) Relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work; or

(2) Waiving the right of the Government to require the fulfillment of all of the terms of the contract.

(g) Reimbursement for bond premiums. In making these progress payments,

the Government shall, upon request, reimburse the Contractor for the amount of premiums paid for performance and payment bonds (including coinsurance and reinsurance agreements, when applicable) after the Contractor has furnished evidence of full payment to the surety. The retainage provisions in paragraph (e) of this clause shall not apply to that portion of progress payments attributable to bond premiums.

(h) Final payment. The Government shall pay the amount due the Contractor under this contract after--

- (1) Completion and acceptance of all work;
- (2) Presentation of a properly executed voucher; and
- (3) Presentation of release of all claims against the Government arising by virtue of this contract, other than claims, in stated amounts, that the Contractor has specifically excepted from the operation of the release. A release may also be required of the assignee if the Contractor's claim to amounts payable under this contract has been assigned under the Assignment of Claims Act of 1940 (31 U.S.C. 3727 and 41 U.S.C. 15).

(i) Limitation because of undefinitized work. Notwithstanding any provision of this contract, progress payments shall not exceed 80 percent on work accomplished on undefinitized contract actions. A "contract action" is any action resulting in a contract, as defined in FAR Subpart 2.1, including contract modifications for additional supplies or services, but not including contract modifications that are within the scope and under the terms of the contract, such as contract modifications issued pursuant to the Changes clause, or funding and other administrative changes.

(j) Interest computation on unearned amounts. In accordance with 31 U.S.C. 3903(c)(1), the amount payable under subparagraph (d)(2) of this clause shall be--

- (1) Computed at the rate of average bond equivalent rates of 91-day Treasury bills auctioned at the most recent auction of such bills prior to the date the Contractor receives the unearned amount; and
- (2) Deducted from the next available payment to the Contractor.

(End of clause)

75 52.232-17 INTEREST (JUN 1996)

(a) Except as otherwise provided in this contract under a Price Reduction for Defective Cost or Pricing Data clause or a Cost Accounting Standards clause, all amounts that become payable by the Contractor to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code (26 U.S.C. 1481)) shall bear simple interest from the date due until paid unless paid within 30 days of becoming due. The interest rate shall be the interest rate established by the Secretary of the Treasury as provided in Section 12 of the Contract Disputes Act of 1978 (Public Law 95-563), which is applicable to the period in which the amount becomes due, as provided in paragraph (b) of this clause, and then at the rate applicable for each six-month period as fixed by the Secretary until the amount is paid.

(b) Amounts shall be due at the earliest of the following dates:

- (1) The date fixed under this contract.
- (2) The date of the first written demand for payment consistent with this contract, including any demand resulting from a default termination.
- (3) The date the Government transmits to the Contractor a proposed supplemental agreement to confirm completed negotiations establishing the amount of debt.

(4) If this contract provides for revision of prices, the date of written notice to the Contractor stating the amount of refund payable in connection with a pricing proposal or a negotiated pricing agreement not confirmed by contract modification.

(c) The interest charge made under this clause may be reduced under the procedures prescribed in 32.614-2 of the Federal Acquisition Regulation in effect on the date of this contract.

(End of clause)

76 52.232-23 ASSIGNMENT OF CLAIMS (JAN 1986)

(a) The Contractor, under the Assignment of Claims Act, as amended, 31 U.S.C. 3727, 41 U.S.C. 15 (hereafter referred to as "the Act"), may assign its rights to be paid amounts due or to become due as a result of the performance of this contract to a bank, trust company, or other financing institution, including any Federal lending agency. The assignee under such an assignment may thereafter further assign or reassign its right under the original assignment to any type of financing institution described in the preceding sentence.

(b) Any assignment or reassignment authorized under the Act and this clause shall cover all unpaid amounts payable under this contract, and shall not be made to more than one party, except that an assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in the financing of this contract.

(c) The Contractor shall not furnish or disclose to any assignee under this contract any classified document (including this contract) or information related to work under this contract until the Contracting Officer authorizes such action in writing.

(End of clause)

77 52.232-27 PROMPT PAYMENT FOR CONSTRUCTION CONTRACTS (JUN 1997)

Notwithstanding any other payment terms in this contract, the Government will make invoice payments and contract financing payments under the terms and conditions specified in this clause. Payment shall be considered as being made on the day a check is dated or the date of an electronic funds transfer. Definitions of pertinent terms are set forth in section 32.902 of the Federal Acquisition Regulation. All days referred to in this clause are calendar days, unless otherwise specified. (However, see subparagraph (a)(3) concerning payments due on Saturdays, Sundays, and legal holidays.)

(a) Invoice payments--

(1) Types of invoice payments. For purposes of this clause, there are several types of invoice payments that may occur under this contract, as follows:

(i) Progress payments, if provided for elsewhere in this contract, based on Contracting Officer approval of the estimated amount and value of work or services performed, including payments for reaching milestones in any project:

(A) The due date for making such payments shall be 14 days after receipt of the payment request by the designated billing office. If the designated billing office fails to annotate the payment request with the actual date of receipt at the time of receipt, the payment due date shall be the 14th day after the date of the Contractor's payment request, provided a proper payment request is received and there is no disagreement over quantity, quality, or Contractor

compliance with contract requirements.

(B) The due date for payment of any amounts retained by the Contracting Officer in accordance with the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts, shall be as specified in the contract or, if not specified, 30 days after approval for release to the Contractor by the Contracting Officer.

(ii) Final payments based on completion and acceptance of all work and presentation of release of all claims against the Government arising by virtue of the contract, and payments for partial deliveries that have been accepted by the Government (e.g., each separate building, public work, or other division of the contract for which the price is stated separately in the contract):

(A) The due date for making such payments shall be either the 30th day after receipt by the designated billing office of a proper invoice from the Contractor, or the 30th day after Government acceptance of the work or services completed by the Contractor, whichever is later. If the designated billing office fails to annotate the invoice with the date of actual receipt at the time of receipt, the invoice payment due date shall be the 30th day after the date of the Contractor's invoice, provided a proper invoice is received and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) On a final invoice where the payment amount is subject to contract settlement actions (e.g., release of claims), acceptance shall be deemed to have occurred on the effective date of the contract settlement.

(2) Contractor's invoice. The Contractor shall prepare and submit invoices to the designated billing office specified in the contract. A proper invoice must include the items listed in paragraphs (a)(2)(i) through (a)(2)(ix) of this clause. If the invoice does not comply with these requirements, it shall be returned within 7 days after the date the designated billing office received the invoice, with a statement of the reasons why it is not a proper invoice. Untimely notification will be taken into account in computing any interest penalty owed the Contractor in the manner described in subparagraph (a)(4) of this clause.

(i) Name and address of the Contractor.

(ii) Invoice date. (The Contractor is encouraged to date invoices as close as possible to the date of mailing or transmission.)

(iii) Contract number or other authorization for work or services performed (including order number and contract line item number).

(iv) Description of work or services performed.

(v) Delivery and payment terms (e.g., prompt payment discount terms).

(vi) Name and address of Contractor official to whom payment is to be sent (must be the same as that in the contract or in a proper notice of assignment).

(vii) Name (where practicable), title, phone number, and mailing address of person to be notified in the event of a defective invoice.

(viii) For payments described in paragraph (a)(1)(i) of this clause, substantiation of the amounts requested and certification in accordance with the requirements of the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts.

(ix) Any other information or documentation required by the contract.

(x) While not required, the Contractor is strongly encouraged to assign an identification number to each invoice.

(3) Interest penalty. An interest penalty shall be paid automatically by the designated payment office, without request from the Contractor, if payment is not made by the due date and the conditions listed in

paragraphs (a)(3)(i) through (a)(3)(iii) of this clause are met, if applicable. However, when the due date falls on a Saturday, Sunday, or legal holiday when Federal Government offices are closed and Government business is not expected to be conducted, payment may be made on the following business day without incurring a late payment interest penalty.

(i) A proper invoice was received by the designated billing office.

(ii) A receiving report or other Government documentation authorizing payment was processed and there was no disagreement over quantity, quality, Contractor compliance with any contract term or condition, or requested progress payment amount.

(iii) In the case of a final invoice for any balance of funds due the Contractor for work or services performed, the amount was not subject to further contract settlement actions between the Government and the Contractor.

(4) Computing penalty amount. The interest penalty shall be at the rate established by the Secretary of the Treasury under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) that is in effect on the day after the due date, except where the interest penalty is prescribed by other governmental authority (e.g., tariffs). This rate is referred to as the "Renegotiation Board Interest Rate," and it is published in the Federal Register semiannually on or about January 1 and July 1. The interest penalty shall accrue daily on the invoice principal payment amount approved by the Government until the payment date of such approved principal amount; and will be compounded in 30-day increments inclusive from the first day after the due date through the payment date. That is, interest accrued at the end of any 30-day period will be added to the approved invoice principal payment amount and will be subject to interest penalties if not paid in the succeeding 30-day period. If the designated billing office failed to notify the Contractor of a defective invoice within the periods prescribed in subparagraph (a)(2) of this clause, the due date on the corrected invoice will be adjusted by subtracting from such date the number of days taken beyond the prescribed notification of defects period. Any interest penalty owed the Contractor will be based on this adjusted due date. Adjustments will be made by the designated payment office for errors in calculating interest penalties.

(i) For the sole purpose of computing an interest penalty that might be due the Contractor for payments described in paragraph (a)(1)(ii) of this clause, Government acceptance or approval shall be deemed to have occurred constructively on the 7th day after the Contractor has completed the work or services in accordance with the terms and conditions of the contract. In the event that actual acceptance or approval occurs within the constructive acceptance or approval period, the determination of an interest penalty shall be based on the actual date of acceptance or approval. Constructive acceptance or constructive approval requirements do not apply if there is a disagreement over quantity, quality, or Contractor compliance with a contract provision. These requirements also do not compel Government officials to accept work or services, approve Contractor estimates, perform contract administration functions, or make payment prior to fulfilling their responsibilities.

(ii) The following periods of time will not be included in the determination of an interest penalty:

(A) The period taken to notify the Contractor of defects in invoices submitted to the Government, but this may not exceed 7 days.

(B) The period between the defects notice and resubmission of the corrected invoice by the Contractor.

(C) For incorrect electronic funds transfer (EFT) information, in

accordance with the EFT clause of this contract.

(iii) Interest penalties will not continue to accrue after the filing of a claim for such penalties under the clause at 52.233-1, Disputes, or for more than 1 year. Interest penalties of less than \$1 need not be paid.

(iv) Interest penalties are not required on payment delays due to disagreement between the Government and the Contractor over the payment amount or other issues involving contract compliance, or on amounts temporarily withheld or retained in accordance with the terms of the contract. Claims involving disputes, and any interest that may be payable, will be resolved in accordance with the clause at 52.233-1, Disputes.

(5) Prompt payment discounts. An interest penalty also shall be paid automatically by the designated payment office, without request from the Contractor, if a discount for prompt payment is taken improperly. The interest penalty will be calculated on the amount of discount taken for the period beginning with the first day after the end of the discount period through the date when the Contractor is paid.

(6) Additional interest penalty.

(i) A penalty amount, calculated in accordance with subdivision (a)(6)(iii) of this clause, shall be paid in addition to the interest penalty amount if the Contractor--

(A) Is owed an interest penalty of \$1 or more;

(B) Is not paid the interest penalty within 10 days after the date the invoice amount is paid; and

(C) Makes a written demand to the designated payment office for additional penalty payment, in accordance with subdivision (a)(6)(ii) of this clause, postmarked not later than 40 days after the date the invoice amount is paid.

(ii)(A) Contractors shall support written demands for additional penalty payments with the following data. No additional data shall be required. Contractors shall--

(1) Specifically assert that late payment interest is due under a specific invoice, and request payment of all overdue late payment interest penalty and such additional penalty as may be required;

(2) Attach a copy of the invoice on which the unpaid late payment interest was due; and

(3) State that payment of the principal has been received, including the date of receipt.

(B) Demands must be postmarked on or before the 40th day after payment was made, except that--

(1) If the postmark is illegible or nonexistent, the demand must have been received and annotated with the date of receipt by the designated payment office on or before the 40th day after payment was made; or

(2) If the postmark is illegible or nonexistent and the designated payment office fails to make the required annotation, the demand's validity will be determined by the date the Contractor has placed on the demand; provided such date is no later than the 40th day after payment was made.

(iii)(A) The additional penalty shall be equal to 100 percent of any original late payment interest penalty, except--

(1) The additional penalty shall not exceed \$5,000;

(2) The additional penalty shall never be less than \$25; and

(3) No additional penalty is owed if the amount of the underlying interest penalty is less than \$1.

(B) If the interest penalty ceases to accrue in accordance with the

limits stated in subdivision (a)(4)(iii) of this clause, the amount of the additional penalty shall be calculated on the amount of interest penalty that would have accrued in the absence of these limits, subject to the overall limits on the additional penalty specified in subdivision (a)(6)(iii)(A) of this clause.

(C) For determining the maximum and minimum additional penalties, the test shall be the interest penalty due on each separate payment made for each separate contract. The maximum and minimum additional penalty shall not be based upon individual invoices unless the invoices are paid separately. Where payments are consolidated for disbursing purposes, the maximum and minimum additional penalty determination shall be made separately for each contract therein.

(D) The additional penalty does not apply to payments regulated by other Government regulations (e.g., payments under utility contracts subject to tariffs and regulation).

(b) Contract financing payments--

(1) Due dates for recurring financing payments. If this contract provides for contract financing, requests for payment shall be submitted to the designated billing office as specified in this contract or as directed by the Contracting Officer. Contract financing payments shall be made on the 30th day after receipt of a proper contract financing request by the designated billing office. In the event that an audit or other review of a specific financing request is required to ensure compliance with the terms and conditions of the contract, the designated payment office is not compelled to make payment by the due date specified.

(2) Due dates for other contract financing. For advance payments, loans, or other arrangements that do not involve recurring submissions of contract financing requests, payment shall be made in accordance with the corresponding contract terms or as directed by the Contracting Officer.

(3) Interest penalty not applicable. Contract financing payments shall not be assessed an interest penalty for payment delays.

(c) Subcontract clause requirements. The Contractor shall include in each subcontract for property or services (including a material supplier) for the purpose of performing this contract the following:

(1) Prompt payment for subcontractors. A payment clause that obligates the Contractor to pay the subcontractor for satisfactory performance under its subcontract not later than 7 days from receipt of payment out of such amounts as are paid to the Contractor under this contract.

(2) Interest for subcontractors. An interest penalty clause that obligates the Contractor to pay to the subcontractor an interest penalty for each payment not made in accordance with the payment clause--

(i) For the period beginning on the day after the required payment date and ending on the date on which payment of the amount due is made; and

(ii) Computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(3) Subcontractor clause flowdown. A clause requiring each subcontractor to include a payment clause and an interest penalty clause conforming to the standards set forth in subparagraphs (c)(1) and (c)(2) of this clause in each of its subcontracts, and to require each of its subcontractors to include such clauses in their subcontracts with each lower-tier subcontractor or supplier.

(d) Subcontract clause interpretation. The clauses required by paragraph

(c) of this clause shall not be construed to impair the right of the Contractor or a subcontractor at any tier to negotiate, and to include in their subcontract, provisions that--

(1) Retainage permitted. Permit the Contractor or a subcontractor to retain (without cause) a specified percentage of each progress payment otherwise due to a subcontractor for satisfactory performance under the subcontract without incurring any obligation to pay a late payment interest penalty, in accordance with terms and conditions agreed to by the parties to the subcontract, giving such recognition as the parties deem appropriate to the ability of a subcontractor to furnish a performance bond and a payment bond;

(2) Withholding permitted. Permit the Contractor or subcontractor to make a determination that part or all of the subcontractor's request for payment may be withheld in accordance with the subcontract agreement; and

(3) Withholding requirements. Permit such withholding without incurring any obligation to pay a late payment penalty if--

(i) A notice conforming to the standards of paragraph (g) of this clause previously has been furnished to the subcontractor; and

(ii) A copy of any notice issued by a Contractor pursuant to subdivision (d)(3)(i) of this clause has been furnished to the Contracting Officer.

(e) Subcontractor withholding procedures. If a Contractor, after making a request for payment to the Government but before making a payment to a subcontractor for the subcontractor's performance covered by the payment request, discovers that all or a portion of the payment otherwise due such subcontractor is subject to withholding from the subcontractor in accordance with the subcontract agreement, then the Contractor shall--

(1) Subcontractor notice. Furnish to the subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon ascertaining the cause giving rise to a withholding, but prior to the due date for subcontractor payment;

(2) Contracting Officer notice. Furnish to the Contracting Officer, as soon as practicable, a copy of the notice furnished to the subcontractor pursuant to subparagraph (e)(1) of this clause;

(3) Subcontractor progress payment reduction. Reduce the subcontractor's progress payment by an amount not to exceed the amount specified in the notice of withholding furnished under subparagraph (e)(1) of this clause;

(4) Subsequent subcontractor payment. Pay the subcontractor as soon as practicable after the correction of the identified subcontract performance deficiency, and--

(i) Make such payment within--

(A) Seven days after correction of the identified subcontract performance deficiency (unless the funds therefor must be recovered from the Government because of a reduction under paragraph (e)(5)(i)) of this clause; or

(B) Seven days after the Contractor recovers such funds from the Government; or

(ii) Incur an obligation to pay a late payment interest penalty computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty;

(5) Notice to Contracting Officer. Notify the Contracting Officer upon--

(i) Reduction of the amount of any subsequent certified application

for payment; or

(ii) Payment to the subcontractor of any withheld amounts of a progress payment, specifying--

(A) The amounts withheld under subparagraph (e)(1) of this clause; and

(B) The dates that such withholding began and ended; and

(6) Interest to Government. Be obligated to pay to the Government an amount equal to interest on the withheld payments (computed in the manner provided in 31 U.S.C. 3903(c)(1)), from the 8th day after receipt of the withheld amounts from the Government until--

(i) The day the identified subcontractor performance deficiency is corrected; or

(ii) The date that any subsequent payment is reduced under subdivision (e)(5)(i) of this clause.

(f) Third-party deficiency reports--

(1) Withholding from subcontractor. If a Contractor, after making payment to a first-tier subcontractor, receives from a supplier or subcontractor of the first-tier subcontractor (hereafter referred to as a "second-tier subcontractor") a written notice in accordance with section 2 of the Act of August 24, 1935 (40 U.S.C. 270b, Miller Act), asserting a deficiency in such first-tier subcontractor's performance under the contract for which the Contractor may be ultimately liable, and the Contractor determines that all or a portion of future payments otherwise due such first-tier subcontractor is subject to withholding in accordance with the subcontract agreement, the Contractor may, without incurring an obligation to pay an interest penalty under subparagraph (e)(6) of this clause--

(i) Furnish to the first-tier subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon making such determination; and

(ii) Withhold from the first-tier subcontractor's next available progress payment or payments an amount not to exceed the amount specified in the notice of withholding furnished under paragraph (f)(1)(i) of this clause.

(2) Subsequent payment or interest charge. As soon as practicable, but not later than 7 days after receipt of satisfactory written notification that the identified subcontract performance deficiency has been corrected, the Contractor shall--

(i) Pay the amount withheld under paragraph (f)(1)(ii) of this clause to such first-tier subcontractor; or

(ii) Incur an obligation to pay a late payment interest penalty to such first-tier subcontractor computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(g) Written notice of subcontractor withholding. A written notice of any withholding shall be issued to a subcontractor (with a copy to the Contracting Officer of any such notice issued by the Contractor), specifying--

(1) The amount to be withheld;

(2) The specific causes for the withholding under the terms of the subcontract; and

(3) The remedial actions to be taken by the subcontractor in order to receive payment of the amounts withheld.

(h) Subcontractor payment entitlement. The Contractor may not request payment from the Government of any amount withheld or retained in

accordance with paragraph (d) of this clause until such time as the Contractor has determined and certified to the Contracting Officer that the subcontractor is entitled to the payment of such amount.

(i) Prime-subcontractor disputes. A dispute between the Contractor and subcontractor relating to the amount or entitlement of a subcontractor to a payment or a late payment interest penalty under a clause included in the subcontract pursuant to paragraph (c) of this clause does not constitute a dispute to which the United States is a party. The United States may not be interpleaded in any judicial or administrative proceeding involving such a dispute.

(j) Preservation of prime-subcontractor rights. Except as provided in paragraph (i) of this clause, this clause shall not limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or a subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor or deficient subcontract performance or nonperformance by a subcontractor.

(k) Non-recourse for prime contractor interest penalty. The Contractor's obligation to pay an interest penalty to a subcontractor pursuant to the clauses included in a subcontract under paragraph (c) of this clause shall not be construed to be an obligation of the United States for such interest penalty. A cost-reimbursement claim may not include any amount for reimbursement of such interest penalty.

(End of clause)

78 52.232-7006 REDUCTION OR SUSPENSION OF CONTRACT PAYMENTS UPON FINDING
OF FRAUD (AUG 1992)

(a) 10 U.S.C. 2307(e) permits the head of the agency to reduce or suspend further payments to the Contractor upon a written determination by the agency head that substantial evidence exists that the Contractor's request for advance, partial, or progress payments is based on fraud. The provisions of 10 U.S.C. 2307(e) are in addition to any other rights or remedies provided the Government by law or under contract.

(b) Actions taken by the Government in accordance with 10 U.S.C. 2307(e) shall not constitute an excusable delay under the Default clause of this contract or otherwise relieve the Contractor of its obligations to perform under this contract.

(End of clause)

79 52.233-1 DISPUTES (OCT 1995)

(a) This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613).

(b) Except as provided in the Act, all disputes arising under or relating to this contract shall be resolved under this clause.

(c) "Claim," as used in this clause, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to this contract. A claim arising under a contract, unlike a claim relating to that contract, is a claim that can be resolved under a contract clause that provides for the relief sought by the claimant. However, a written demand or written assertion by the Contractor seeking the payment of money exceeding \$100,000 is not a claim under the Act until certified as required by subparagraph (d)(2) of this clause. A voucher, invoice, or other routine request for

payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

(d)(1) A claim by the Contractor shall be made in writing and, unless otherwise stated in this contract, submitted within 6 years after accrual of the claim to the Contracting Officer for a written decision. A claim by the Government against the Contractor shall be subject to a written decision by the Contracting Officer.

(2)(i) Contractors shall provide the certification specified in subparagraph (d)(2)(iii) of this clause when submitting any claim--

(A) Exceeding \$100,000; or

(B) Regardless of the amount claimed, when using--

(1) Arbitration conducted pursuant to 5 U.S.C. 575-580; or

(2) Any other alternative means of dispute resolution (ADR) technique that the agency elects to handle in accordance with the Administrative Dispute Resolution Act (ADRA).

(ii) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.

(iii) The certification shall state as follows:

"I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Contractor believes the Government is liable; and that I am duly authorized to certify the claim on behalf of the Contractor."

(3) The certification may be executed by any person duly authorized to bind the Contractor with respect to the claim.

(e) For Contractor claims of \$100,000 or less, the Contracting Officer must, if requested in writing by the Contractor, render a decision within 60 days of the request. For Contractor-certified claims over \$100,000, the Contracting Officer must, within 60 days, decide the claim or notify the Contractor of the date by which the decision will be made.

(f) The Contracting Officer's decision shall be final unless the Contractor appeals or files a suit as provided in the Act.

(g) If the claim by the Contractor is submitted to the Contracting Officer or a claim by the Government is presented to the Contractor, the parties, by mutual consent, may agree to use ADR. If the Contractor refuses an offer for alternative disputes resolution, the Contractor shall inform the Contracting Officer, in writing, of the Contractor's specific reasons for rejecting the request. When using arbitration conducted pursuant to 5 U.S.C. 575-580, or when using any other ADR technique that the agency elects to handle in accordance with the ADRA, any claim, regardless of amount, shall be accompanied by the certification described in subparagraph (d)(2)(iii) of this clause, and executed in accordance with subparagraph (d)(3) of this clause.

(h) The Government shall pay interest on the amount found due and unpaid from (1) the date that the Contracting Officer receives the claim (certified, if required); or (2) the date that payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certifications, as defined in (FAR) 48 CFR 33.201, interest shall be paid from the date that the Contracting Officer initially receives the claim. Simple interest on claims shall be paid at the rate, fixed by the Secretary of the Treasury as provided in the Act, which is applicable to the period during which the Contracting Officer receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

(i) The Contractor shall proceed diligently with performance of this contract, pending final resolution of any request for relief, claim, appeal, or action arising under the contract, and comply with any decision of the Contracting Officer.

(End of clause)

80 52.233-3 PROTEST AFTER AWARD (AUG 1996)

(a) Upon receipt of a notice of protest (as defined in FAR 33.101) or a determination that a protest is likely (see FAR 33.102(d)), the Contracting Officer may, by written order to the Contractor, direct the Contractor to stop performance of the work called for by this contract. The order shall be specifically identified as a stop-work order issued under this clause. Upon receipt of the order, the Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of costs allocable to the work covered by the order during the period of work stoppage. Upon receipt of the final decision in the protest, the Contracting Officer shall either--

(1) Cancel the stop-work order; or

(2) Terminate the work covered by the order as provided in the Default, or the Termination for Convenience of the Government, clause of this contract.

(b) If a stop-work order issued under this clause is canceled either before or after a final decision in the protest, the Contractor shall resume work. The Contracting Officer shall make an equitable adjustment in the delivery schedule or contract price, or both, and the contract shall be modified, in writing, accordingly, if--

(1) The stop-work order results in an increase in the time required for, or in the Contractor's cost properly allocable to, the performance of any part of this contract; and

(2) The Contractor asserts its right to an adjustment within 30 days after the end of the period of work stoppage; provided, that if the Contracting Officer decides the facts justify the action, the Contracting Officer may receive and act upon a proposal at any time before final payment under this contract.

(c) If a stop-work order is not canceled and the work covered by the order is terminated for the convenience of the Government, the Contracting Officer shall allow reasonable costs resulting from the stop-work order in arriving at the termination settlement.

(d) If a stop-work order is not canceled and the work covered by the order is terminated for default, the Contracting Officer shall allow, by equitable adjustment or otherwise, reasonable costs resulting from the stop-work order.

(e) The Government's rights to terminate this contract at any time are not affected by action taken under this clause.

(f) If, as the result of the Contractor's intentional or negligent misstatement, misrepresentation, or miscertification, a protest related to this contract is sustained, and the Government pays costs, as provided in FAR 33.102(b)(2) or 33.104(h)(1), the Government may require the Contractor to reimburse the Government the amount of such costs. In addition to any other remedy available, and pursuant to the requirements of Subpart 32.6, the Government may collect this debt by offsetting the amount against any payment due the Contractor under any contract between the Contractor and the Government.

(End of clause)

81 52.236-1 PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984)

The Contractor shall perform on the site, and with its own organization, work equivalent to at least twenty-five percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

(End of clause)

(R 7-603.15 1965 JAN)

(R 1-18.104)

82 52.236-2 DIFFERING SITE CONDITIONS (APR 1984)

(a) The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the Contracting Officer of (1) subsurface or latent physical conditions at the site which differ materially from those indicated in this contract, or (2) unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

(b) The Contracting Officer shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, an equitable adjustment shall be made under this clause and the contract modified in writing accordingly.

(c) No request by the Contractor for an equitable adjustment to the contract under this clause shall be allowed, unless the Contractor has given the written notice required; provided, that the time prescribed in (a) above for giving written notice may be extended by the Contracting Officer.

(d) No request by the Contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under this contract.

(End of clause)

83 52.236-3 SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK (APR 1984)

(a) The Contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and roads; (3) uncertainties of weather, river stages, tides, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this

information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Government, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the Government.

(b) The Government assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the Government. Nor does the Government assume responsibility for any understanding reached or representation made concerning conditions which can affect the work by any of its officers or agents before the execution of this contract, unless that understanding or representation is expressly stated in this contract.

(End of clause)

84 52.236-5 MATERIAL AND WORKMANSHIP (APR 1984)

(a) All equipment, material, and articles incorporated into the work covered by this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.

(b) The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide full information concerning the material or articles. When directed to do so, the Contractor shall submit samples for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection.

(c) All work under this contract shall be performed in a skillful and workmanlike manner. The Contracting Officer may require, in writing, that the Contractor remove from the work any employee the Contracting Officer deems incompetent, careless, or otherwise objectionable.

(End of clause)

(R 7-602.9 1964 JUN)

85 52.236-6 SUPERINTENDENCE BY THE CONTRACTOR (APR 1984)

At all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work

or assign and have on the work site a competent superintendent who is satisfactory to the Contracting Officer and has authority to act for the Contractor.

(End of clause)

86 52.236-7 PERMITS AND RESPONSIBILITIES (NOV 1991)

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State, and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

(End of clause)

87 52.236-8 OTHER CONTRACTS (APR 1984)

The Government may undertake or award other contracts for additional work at or near the site of the work under this contract. The Contractor shall fully cooperate with the other contractors and with Government employees and shall carefully adapt scheduling and performing the work under this contract to accommodate the additional work, heeding any direction that may be provided by the Contracting Officer. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor or by Government employees.

(End of clause)

88 52.236-9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (APR 1984)

(a) The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

(b) The Contractor shall protect from damage all existing improvements and utilities (1) at or near the work site, and (2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

(End of clause)

89 52.236-10 OPERATIONS AND STORAGE AREAS (APR 1984)

(a) The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

(b) Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

(c) The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

(End of clause)

90 52.236-11 USE AND POSSESSION PRIOR TO COMPLETION (APR 1984)

(a) The Government shall have the right to take possession of or use any completed or partially completed part of the work. Before taking possession of or using any work, the Contracting Officer shall furnish the Contractor a list of items of work remaining to be performed or corrected on those portions of the work that the Government intends to take possession of or use. However, failure of the Contracting Officer to list any item of work shall not relieve the Contractor of responsibility for complying with the terms of the contract. The Government's possession or use shall not be deemed an acceptance of any work under the contract.

(b) While the Government has such possession or use, the Contractor shall be relieved of the responsibility for the loss of or damage to the work resulting from the Government's possession or use, notwithstanding the terms of the clause in this contract entitled "Permits and Responsibilities." If prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment shall be made in the contract price or the time of completion, and the contract shall be modified in writing accordingly.

(End of clause)

91 52.236-12 CLEANING UP (APR 1984)

The Contractor shall at all times keep the work area, including storage areas, free from accumulations of waste materials. Before completing the work, the Contractor shall remove from the work and premises any rubbish, tools, scaffolding, equipment, and materials that are not the property of

the Government. Upon completing the work, the Contractor shall leave the work area in a clean, neat, and orderly condition satisfactory to the Contracting Officer.

(End of clause)

92 52.236-13 ACCIDENT PREVENTION (NOV 1991)

(a) The Contractor shall provide and maintain work environments and procedures which will (1) safeguard the public and Government personnel, property, materials, supplies, and equipment exposed to Contractor operations and activities; (2) avoid interruptions of Government operations and delays in project completion dates; and (3) control costs in the performance of this contract.

(b) For these purposes on contracts for construction or dismantling, demolition, or removal of improvements, the Contractor shall--

(1) Provide appropriate safety barricades, signs, and signal lights;

(2) Comply with the standards issued by the Secretary of Labor at 29 CFR Part 1926 and 29 CFR Part 1910; and

(3) Ensure that any additional measures the Contracting Officer determines to be reasonably necessary for the purposes are taken.

(c) If this contract is for construction or dismantling, demolition or removal of improvements with any Department of Defense agency or component, the Contractor shall comply with all pertinent provisions of the latest version of U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, in effect on the date of the solicitation.

(d) Whenever the Contracting Officer becomes aware of any noncompliance with these requirements or any condition which poses a serious or imminent danger to the health or safety of the public or Government personnel, the Contracting Officer shall notify the Contractor orally, with written confirmation, and request immediate initiation of corrective action. This notice, when delivered to the Contractor or the Contractor's representative at the work site, shall be deemed sufficient notice of the noncompliance and that corrective action is required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.

(e) The Contractor shall insert this clause, including this paragraph (e), with appropriate changes in the designation of the parties, in subcontracts.

(End of clause)

93 52.236-15 SCHEDULES FOR CONSTRUCTION CONTRACTS (APR 1984)

(a) The Contractor shall, within five days after the work commences on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given

date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule.

(b) The Contractor shall enter the actual progress on the chart as directed by the Contracting Officer, and upon doing so shall immediately deliver three copies of the annotated schedule to the Contracting Officer. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this contract.

(End of clause)

94 52.236-17 LAYOUT OF WORK (APR 1984)

The Contractor shall lay out its work from Government-established base lines and bench marks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through its negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

(End of clause)

(R 7-604.3 1965 JAN)

95 52.236-21 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FEB 1997)

(a) The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense. The Contracting Officer shall

furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

(b) Wherever in the specifications or upon the drawings the words "directed", "required", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the "direction", "requirement", "order", "designation", or "prescription", of the Contracting Officer is intended and similarly the words "approved", "acceptable", "satisfactory", or words of like import shall mean "approved by", or "acceptable to", or "satisfactory to" the Contracting Officer, unless otherwise expressly stated.

(c) Where "as shown," "as indicated", "as detailed", or words of similar import are used, it shall be understood that the reference is made to the drawings accompanying this contract unless stated otherwise. The word "provided" as used herein shall be understood to mean "provide complete in place," that is "furnished and installed".

(d) Shop drawings means drawings, submitted to the Government by the Contractor, subcontractor, or any lower tier subcontractor pursuant to a construction contract, showing in detail (1) the proposed fabrication and assembly of structural elements, and (2) the installation (i.e., fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the contractor to explain in detail specific portions of the work required by the contract. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(e) If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for resubmission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the Government's reasons therefor. Any work done before such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (f) below.

(f) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation, the Contracting Officer shall issue an appropriate contract modification, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

(g) The Contractor shall submit to the Contracting Officer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the Contracting Officer and one set will be returned to the Contractor.

(End of clause)

(a) The Contractor shall furnish a price breakdown, itemized as required and within the time specified by the Contracting Officer, with any proposal for a contract modification.

(b) The price breakdown--

(1) Must include sufficient detail to permit an analysis of profit, and of all costs for--

- (i) Material;
- (ii) Labor;
- (iii) Equipment;
- (iv) Subcontracts; and
- (v) Overhead; and

(2) Must cover all work involved in the modification, whether the work was deleted, added, or changed.

(c) The Contractor shall provide similar price breakdowns to support any amounts claimed for subcontracts.

(d) The Contractor's proposal shall include a justification for any time extension proposed.

(End of clause)

97 52.242-13 BANKRUPTCY (JUL 1995)

In the event the Contractor enters into proceedings relating to bankruptcy, whether voluntary or involuntary, the Contractor agrees to furnish, by certified mail or electronic commerce method authorized by the contract, written notification of the bankruptcy to the Contracting Officer responsible for administering the contract. This notification shall be furnished within five days of the initiation of the proceedings relating to bankruptcy filing. This notification shall include the date on which the bankruptcy petition was filed, the identity of the court in which the bankruptcy petition was filed, and a listing of Government contract numbers and contracting offices for all Government contracts against which final payment has not been made. This obligation remains in effect until final payment under this contract.

(End of clause)

98 52.242-14 SUSPENSION OF WORK (APR 1984)

(a) The Contracting Officer may order the Contractor, in writing, to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the Government.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted (1) by an act of the Contracting Officer in the administration of this contract, or (2) by the Contracting Officer's failure to act within the time specified in this contract (or within a reasonable time if not specified), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by the unreasonable suspension, delay, or interruption, and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or for which an equitable adjustment is provided for or excluded under any other term or condition of this contract.

(c) A claim under this clause shall not be allowed (1) for any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order), and (2) unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.

(End of clause)

99 52.242-7000 POSTAWARD CONFERENCE (DEC 1991)

The Contractor agrees to attend any postaward conference convened by the contracting activity or contract administration office in accordance with Federal Acquisition Regulation Subpart 42.5.

(End of clause)

100 52.243-4 CHANGES (AUG 1987)

(a) The Contracting Officer may, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including changes--

- (1) In the specifications (including drawings and designs);
- (2) In the method or manner of performance of the work;
- (3) In the Government-furnished facilities, equipment, materials, services, or site; or
- (4) Directing acceleration in the performance of the work.

(b) Any other written or oral order (which, as used in this paragraph (b), includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; provided, that the Contractor gives the Contracting Officer written notice stating (1) the date, circumstances, and source of the order and (2) that the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement, or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for an adjustment based on defective specifications, no adjustment for any change under paragraph (b) of this clause shall be made for any costs incurred more than 20 days before the Contractor gives written notice as required. In the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after (1) receipt of a written change order under paragraph (a) of this clause or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting to the Contracting Officer a written statement describing the general nature and amount of the proposal, unless this period is extended by the Government. The statement

of proposal for adjustment may be included in the notice under paragraph (b) above.

(f) No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

(End of clause)

101 52.243-7001 PRICING OF CONTRACT MODIFICATIONS (DEC 1991)

When costs are a factor in any price adjustment under this contract, the contract cost principles and procedures in FAR Part 31 and DFARS Part 231, in effect on the date of this contract, apply.

(End of clause)

102 52.244-1 SUBCONTRACTS (FIXED-PRICE CONTRACTS) (OCT 1997)

(a) This clause does not apply to firm-fixed-price contracts and fixed-price contracts with economic price adjustment. However, it does apply to subcontracts resulting from unpriced modifications to such contracts.

(b) "Subcontract," as used in this clause, includes but is not limited to purchase orders, and changes and modifications to purchase orders. The Contractor shall notify the Contracting Officer reasonably in advance of entering into any subcontract if the Contractor does not have an approved purchasing system and if the subcontract--

(1) Is proposed to exceed \$100,000; or

(2) Is one of a number of subcontracts with a single subcontractor, under this contract, for the same or related supplies or services, that in the aggregate are expected to exceed \$100,000.

(c) The advance notification required by paragraph (b) above shall include--

(1) A description of the supplies or services to be subcontracted;

(2) Identification of the type of subcontract to be used;

(3) Identification of the proposed subcontractor and an explanation of why and how the proposed subcontractor was selected, including the competition obtained;

(4) The proposed subcontract price and the Contractor's cost or price analysis;

(5) The subcontractor's current, complete, and accurate cost or pricing data and Certificate of Current Cost or Pricing Data, if required by other contract provisions;

(6) The subcontractor's Disclosure Statement or Certificate relating to Cost Accounting Standards when such data are required by other provisions of this contract; and

(7) A negotiation memorandum reflecting--

(i) The principal elements of the subcontract price negotiations;

(ii) The most significant considerations controlling establishment of initial or revised prices;

(iii) The reason cost or pricing data were or were not required;

(iv) The extent, if any, to which the Contractor did not rely on the subcontractor's cost or pricing data in determining the price objective and in negotiating the final price;

(v) The extent, if any, to which it was recognized in the negotiation that the subcontractor's cost or pricing data were not accurate, complete, or current; the action taken by the Contractor and subcontractor; and the effect of any such defective data on the total price negotiated;

(vi) The reasons for any significant difference between the Contractor's price objective and the price negotiated; and

(vii) A complete explanation of the incentive fee or profit plan when incentives are used. The explanation shall identify each critical performance element, management decisions used to quantify each incentive element, reasons for the incentives, and a summary of all trade-off possibilities considered.

(d) The Contractor shall obtain the Contracting Officer's written consent before placing any subcontract for which advance notification is required under paragraph (b) above. However, the Contracting Officer may ratify in writing any such subcontract. Ratification shall constitute the consent of the Contracting Officer.

(e) Even if the Contractor's purchasing system has been approved, the Contractor shall obtain the Contracting Officer's written consent before placing subcontracts identified below: none

(f) Unless the consent or approval specifically provides otherwise, neither consent by the Contracting Officer to any subcontract nor approval of the Contractor's purchasing system shall constitute a determination (1) of the acceptability of any subcontract terms or conditions, (2) of the acceptability of any subcontract price or of any amount paid under any subcontract, or (3) to relieve the Contractor of any responsibility for performing this contract.

(g) No subcontract placed under this contract shall provide for payment on a cost-plus-a-percentage-of-cost basis, and any fee payable under cost-reimbursement subcontracts shall not exceed the fee limitations in subsection 15.404-4(c)(4)(i) of the Federal Acquisition Regulation (FAR).

(h) The Government reserves the right to review the Contractor's purchasing system as set forth in FAR Subpart 44.3.

(End of clause)

103 52.246-12 INSPECTION OF CONSTRUCTION (AUG 1996)

(a) Definition. "Work" includes, but is not limited to, materials, workmanship, and manufacture and fabrication of components.

(b) The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Government. All work shall be conducted under the general direction of the Contracting Officer and is subject to Government inspection and test at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.

(c) Government inspections and tests are for the sole benefit of the Government and do not--

(1) Relieve the Contractor of responsibility for providing adequate quality control measures;

(2) Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;

(3) Constitute or imply acceptance; or

(4) Affect the continuing rights of the Government after acceptance of the completed work under paragraph (i) below.

(d) The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specification without the Contracting Officer's written authorization.

(e) The Contractor shall promptly furnish, at no increase in contract

price, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Contracting Officer. The Government may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes reinspection or retest necessary. The Government shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.

(f) The Contractor shall, without charge, replace or correct work found by the Government not to conform to contract requirements, unless in the public interest the Government consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

(g) If the Contractor does not promptly replace or correct rejected work, the Government may (1) by contract or otherwise, replace or correct the work and charge the cost to the Contractor or (2) terminate for default the Contractor's right to proceed.

(h) If, before acceptance of the entire work, the Government decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Contracting Officer shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

(i) Unless otherwise specified in the contract, the Government shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the Contracting Officer determines can be accepted separately. Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the Government's rights under any warranty or guarantee.

(End of clause)

104 52.246-21 WARRANTY OF CONSTRUCTION (MAR 1994)

(a) In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph (i) of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

(b) This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

(c) The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of--

(1) The Contractor's failure to conform to contract requirements; or

(2) Any defect of equipment, material, workmanship, or design furnished.

(d) The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

(e) The Contracting Officer shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage.

(f) If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

(g) With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall--

(1) Obtain all warranties that would be given in normal commercial practice;

(2) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

(3) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

(h) In the event the Contractor's warranty under paragraph (b) of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

(i) Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.

(j) This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

(End of clause)
(R 7-604.4 1976 JUL)

105 52.247-7023 TRANSPORTATION OF SUPPLIES BY SEA (NOV 1995)

(a) Definitions. As used in this clause--

(1) "Components" means articles, materials, and supplies incorporated directly into end products at any level of manufacture, fabrication, or assembly by the Contractor or any subcontractor.

(2) "Department of Defense (DoD)" means the Army, Navy, Air Force, Marine Corps, and defense agencies.

(3) "Foreign flag vessel" means any vessel that is not a U.S.-flag vessel.

(4) "Ocean transportation" means any transportation aboard a ship, vessel, boat, barge, or ferry through international waters.

(5) "Subcontractor" means a supplier, materialman, distributor, or vendor at any level below the prime contractor whose contractual obligation to perform results from, or is conditioned upon, award of the prime contract and who is performing any part of the work or other requirement of the prime contract. However, effective May 1, 1996, the term does not include a supplier, materialman, distributor, or vendor of commercial items or commercial components.

(6) "Supplies" means all property, except land and interests in land, that is clearly identifiable for eventual use by or owned by the DoD at the time of transportation by sea.

(i) An item is clearly identifiable for eventual use by the DoD if, for example, the contract documentation contains a reference to a DoD contract number or a military destination.

(ii) Supplies includes (but is not limited to) public works; buildings and facilities; ships; floating equipment and vessels of every character, type, and description, with parts, subassemblies, accessories, and equipment; machine tools; material; equipment; stores of all kinds; end items; construction materials; and components of the foregoing.

(7) "U.S.-flag vessel" means a vessel of the United States or belonging to the United States, including any vessel registered or having national status under the laws of the United States.

(b) The Contractor shall employ U.S.-flag vessels in the transportation by sea of any supplies to be furnished in the performance of this contract. The Contractor and its subcontractors may request that the Contracting Officer authorize shipment in foreign-flag vessels, or designate available U.S.-flag vessels, if the Contractor or a subcontractor believes that--

- (1) U.S.-flag vessels are not available for timely shipment;
- (2) The freight charges are inordinately excessive or unreasonable; or
- (3) Freight charges are higher than charges to private persons for transportation of like goods.

(c) The Contractor must submit any request for use of other than U.S.-flag vessels in writing to the Contracting Officer at least 45 days prior to the sailing date necessary to meet its delivery schedules. The Contracting Officer will process requests submitted after such date(s) as expeditiously as possible, but the Contracting Officer's failure to grant approvals to meet the shipper's sailing date will not of itself constitute a compensable delay under this or any other clause of this contract.

Requests shall contain at a minimum--

- (1) Type, weight, and cube of cargo;
- (2) Required shipping date;
- (3) Special handling and discharge requirements;
- (4) Loading and discharge points;
- (5) Name of shipper and consignee;
- (6) Prime contract number; and
- (7) A documented description of efforts made to secure U.S.-flag vessels, including points of contact (with names and telephone numbers) with at least two U.S.-flag carriers contacted. Copies of telephone notes, telegraphic and facsimile message or letters will be sufficient for this purpose.

(d) The Contractor shall, within 30 days after each shipment covered by this clause, provide the Contracting Officer and the Division of National Cargo, Office of Market Development, Maritime Administration, U.S. Department of Transportation, Washington, DC 20590, one copy of the rated on board vessel operating carrier's ocean bill of lading, which shall contain the following information--

- (1) Prime contract number;
- (2) Name of vessel;
- (3) Vessel flag of registry;
- (4) Date of loading;
- (5) Port of loading;
- (6) Port of final discharge;
- (7) Description of commodity;
- (8) Gross weight in pounds and cubic feet if available;
- (9) Total ocean freight in U.S. dollars; and
- (10) Name of the steamship company.

(e) The Contractor agrees to provide with its final invoice under this

contract a representation that to the best of its knowledge and belief--

(1) No ocean transportation was used in the performance of this contract;

(2) Ocean transportation was used and only U.S.-flag vessels were used for all ocean shipments under the contract;

(3) Ocean transportation was used, and the Contractor had the written consent of the Contracting Officer for all non-U.S.-flag ocean transportation; or

(4) Ocean transportation was used and some or all of the shipments were made on non-U.S.-flag vessels without the written consent of the Contracting Officer. The Contractor shall describe these shipments in the following format:

	Item Description	Contract Line Items	Quantity
Total.....			

(f) If the final invoice does not include the required representation, the Government will reject and return it to the Contractor as an improper invoice for the purposes of the Prompt Payment clause of this contract. In the event there has been unauthorized use of non-U.S.-flag vessels in the performance of this contract, the Contracting Officer is entitled to equitably adjust the contract, based on the unauthorized use.

(g) The Contractor shall include this clause, including this paragraph (g) in all subcontracts under this contract, which exceed the simplified acquisition threshold in Part 13 of the Federal Acquisition Regulation.

(End of clause)

106 52.247-7024 NOTIFICATION OF TRANSPORTATION OF SUPPLIES BY SEA (NOV 1995)

(a) The Contractor has indicated by the response to the solicitation provision, Representation of Extent of Transportation by Sea, that it did not anticipate transporting by sea any supplies. If, however, after the award of this contract, the Contractor learns that supplies, as defined in the Transportation of Supplies by Sea clause of this contract, will be transported by sea, the Contractor--

(1) Shall notify the Contracting Officer of that fact; and

(2) Hereby agrees to comply with all the terms and conditions of the Transportation of Supplies by Sea clause of this contract.

(b) The Contractor shall include this clause, including this paragraph (b), revised as necessary to reflect the relationship of the contracting parties, in all subcontracts hereunder, except (effective May 1, 1996) subcontracts for the acquisition of commercial items or components.

(End of clause)

107 52.248-3 VALUE ENGINEERING--CONSTRUCTION (MAR 1989)

(a) General. The Contractor is encouraged to develop, prepare, and submit value engineering change proposals (VECP's) voluntarily. The Contractor shall share in any instant contract savings realized from accepted VECP's, in accordance with paragraph (f) below.

(b) Definitions. "Collateral costs," as used in this clause, means

agency costs of operation, maintenance, logistic support, or Government-furnished property.

"Collateral savings," as used in this clause, means those measurable net reductions resulting from a VECP in the agency's overall projected collateral costs, exclusive of acquisition savings, whether or not the acquisition cost changes.

"Contractor's development and implementation costs," as used in this clause, means those costs the Contractor incurs on a VECP specifically in developing, testing, preparing, and submitting the VECP, as well as those costs the Contractor incurs to make the contractual changes required by Government acceptance of a VECP.

"Government costs," as used in this clause, means those agency costs that result directly from developing and implementing the VECP, such as any net increases in the cost of testing, operations, maintenance, and logistic support. The term does not include the normal administrative costs of processing the VECP.

"Instant contract savings," as used in this clause, means the estimated reduction in Contractor cost of performance resulting from acceptance of the VECP, minus allowable Contractor's development and implementation costs, including subcontractors' development and implementation costs (see paragraph (h) below).

"Value engineering change proposal (VECP)" means a proposal that--

- (1) Requires a change to this, the instant contract, to implement; and
- (2) Results in reducing the contract price or estimated cost without impairing essential functions or characteristics; provided, that it does not involve a change--

- (i) In deliverable end item quantities only; or

- (ii) To the contract type only.

(c) VECP preparation. As a minimum, the Contractor shall include in each VECP the information described in subparagraphs (1) through (7) below. If the proposed change is affected by contractually required configuration management or similar procedures, the instructions in those procedures relating to format, identification, and priority assignment shall govern VECP preparation. The VECP shall include the following:

- (1) A description of the difference between the existing contract requirement and that proposed, the comparative advantages and disadvantages of each, a justification when an item's function or characteristics are being altered, and the effect of the change on the end item's performance.

- (2) A list and analysis of the contract requirements that must be changed if the VECP is accepted, including any suggested specification revisions.

- (3) A separate, detailed cost estimate for (i) the affected portions of the existing contract requirement and (ii) the VECP. The cost reduction associated with the VECP shall take into account the Contractor's allowable development and implementation costs, including any amount attributable to subcontracts under paragraph (h) below.

- (4) A description and estimate of costs the Government may incur in implementing the VECP, such as test and evaluation and operating and support costs.

- (5) A prediction of any effects the proposed change would have on collateral costs to the agency.

- (6) A statement of the time by which a contract modification accepting the VECP must be issued in order to achieve the maximum cost reduction, noting any effect on the contract completion time or delivery schedule.

- (7) Identification of any previous submissions of the VECP, including the dates submitted, the agencies and contract numbers involved, and

previous Government actions, if known.

(d) Submission. The Contractor shall submit VECP's to the Resident Engineer at the worksite, with a copy to the Contracting Officer.

(e) Government action. (1) The Contracting Officer shall notify the Contractor of the status of the VECP within 45 calendar days after the contracting office receives it. If additional time is required, the Contracting Officer shall notify the Contractor within the 45-day period and provide the reason for the delay and the expected date of the decision. The Government will process VECP's expeditiously; however, it shall not be liable for any delay in acting upon a VECP.

(2) If the VECP is not accepted, the Contracting Officer shall notify the Contractor in writing, explaining the reasons for rejection. The Contractor may withdraw any VECP, in whole or in part, at any time before it is accepted by the Government. The Contracting Officer may require that the Contractor provide written notification before undertaking significant expenditures for VECP effort.

(3) Any VECP may be accepted, in whole or in part, by the Contracting Officer's award of a modification to this contract citing this clause. The Contracting Officer may accept the VECP, even though an agreement on price reduction has not been reached, by issuing the Contractor a notice to proceed with the change. Until a notice to proceed is issued or a contract modification applies a VECP to this contract, the Contractor shall perform in accordance with the existing contract. The Contracting Officer's decision to accept or reject all or part of any VECP shall be final and not subject to the Disputes clause or otherwise subject to litigation under the Contract Disputes Act of 1978 (41 U.S.C. 601-613).

(f) Sharing. (1) Rates. The Government's share of savings is determined by subtracting Government costs from instant contract savings and multiplying the result by (i) 45 percent for fixed-price contracts or (ii) 75 percent for cost-reimbursement contracts.

(2) Payment. Payment of any share due the Contractor for use of a VECP on this contract shall be authorized by a modification to this contract to--

- (i) Accept the VECP;
- (ii) Reduce the contract price or estimated cost by the amount of instant contract savings; and
- (iii) Provide the Contractor's share of savings by adding the amount calculated to the contract price or fee.

(g) Collateral savings. If a VECP is accepted, the instant contract amount shall be increased by 20 percent of any projected collateral savings determined to be realized in a typical year of use after subtracting any Government costs not previously offset. However, the Contractor's share of collateral savings shall not exceed (1) the contract's firm-fixed-price or estimated cost, at the time the VECP is accepted, or (2) \$100,000, whichever is greater. The Contracting Officer shall be the sole determiner of the amount of collateral savings, and that amount shall not be subject to the Disputes clause or otherwise subject to litigation under 41 U.S.C. 601-613.

(h) Subcontracts. The Contractor shall include an appropriate value engineering clause in any subcontract of \$50,000 or more and may include one in subcontracts of lesser value. In computing any adjustment in this contract's price under paragraph (f) above, the Contractor's allowable development and implementation costs shall include any subcontractor's allowable development and implementation costs clearly resulting from a VECP accepted by the Government under this contract, but shall exclude any value engineering incentive payments to a subcontractor. The Contractor may choose any arrangement for subcontractor value engineering incentive

payments; provided, that these payments shall not reduce the Government's share of the savings resulting from the VECP.

(i) Data. The Contractor may restrict the Government's right to use any part of a VECP or the supporting data by marking the following legend on the affected parts:

"These data, furnished under the Value Engineering--Construction clause of contract _____, shall not be disclosed outside the Government or duplicated, used, or disclosed, in whole or in part, for any purpose other than to evaluate a value engineering change proposal submitted under the clause. This restriction does not limit the Government's right to use information contained in these data if it has been obtained or is otherwise available from the Contractor or from another source without limitations."

If a VECP is accepted, the Contractor hereby grants the Government unlimited rights in the VECP and supporting data, except that, with respect to data qualifying and submitted as limited rights technical data, the Government shall have the rights specified in the contract modification implementing the VECP and shall appropriately mark the data. (The terms "unlimited rights" and "limited rights" are defined in Part 27 of the Federal Acquisition Regulation.)

(End of clause)

108 52.249-2 I TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) (SEP 1996)-- ALTERNATE I (SEP 1996)

(a) The Government may terminate performance of work under this contract in whole or, from time to time, in part if the Contracting Officer determines that a termination is in the Government's interest. The Contracting Officer shall terminate by delivering to the Contractor a Notice of Termination specifying the extent of termination and the effective date.

(b) After receipt of a Notice of Termination, and except as directed by the Contracting Officer, the Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due under this clause:

(1) Stop work as specified in the notice.

(2) Place no further subcontracts or orders (referred to as subcontracts in this clause) for materials, services, or facilities, except as necessary to complete the continued portion of the contract.

(3) Terminate all subcontracts to the extent they relate to the work terminated.

(4) Assign to the Government, as directed by the Contracting Officer, all right, title, and interest of the Contractor under the subcontracts terminated, in which case the Government shall have the right to settle or to pay any termination settlement proposal arising out of those terminations.

(5) With approval or ratification to the extent required by the Contracting Officer, settle all outstanding liabilities and termination settlement proposals arising from the termination of subcontracts; the approval or ratification will be final for purposes of this clause.

(6) As directed by the Contracting Officer, transfer title and deliver to the Government (i) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced or acquired for the work terminated, and (ii) the completed or partially completed plans, drawings, information, and other property that, if the contract had been completed, would be required to be furnished to the

Government.

(7) Complete performance of the work not terminated.

(8) Take any action that may be necessary, or that the Contracting Officer may direct, for the protection and preservation of the property related to this contract that is in the possession of the Contractor and in which the Government has or may acquire an interest.

(9) Use its best efforts to sell, as directed or authorized by the Contracting Officer, any property of the types referred to in subparagraph (b)(6) of this clause; provided, however, that the Contractor (i) is not required to extend credit to any purchaser and (ii) may acquire the property under the conditions prescribed by, and at prices approved by, the Contracting Officer. The proceeds of any transfer or disposition will be applied to reduce any payments to be made by the Government under this contract, credited to the price or cost of the work, or paid in any other manner directed by the Contracting Officer.

(c) The Contractor shall submit complete termination inventory schedules no later than 120 days from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 120-day period.

(d) After expiration of the plant clearance period as defined in Subpart 45.6 of the Federal Acquisition Regulation, the Contractor may submit to the Contracting Officer a list, certified as to quantity and quality, of termination inventory not previously disposed of, excluding items authorized for disposition by the Contracting Officer. The Contractor may request the Government to remove those items or enter into an agreement for their storage. Within 15 days, the Government will accept title to those items and remove them or enter into a storage agreement. The Contracting Officer may verify the list upon removal of the items, or if stored, within 45 days from submission of the list, and shall correct the list, as necessary, before final settlement.

(e) After termination, the Contractor shall submit a final termination settlement proposal to the Contracting Officer in the form and with the certification prescribed by the Contracting Officer. The Contractor shall submit the proposal promptly, but no later than 1 year from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 1 year period. However, if the Contracting Officer determines that the facts justify it, a termination settlement proposal may be received and acted on after 1 year or any extension. If the Contractor fails to submit the proposal within the time allowed, the Contracting Officer may determine, on the basis of information available, the amount, if any, due the Contractor because of the termination and shall pay the amount determined.

(f) Subject to paragraph (e) of this clause, the Contractor and the Contracting Officer may agree upon the whole or any part of the amount to be paid or remaining to be paid because of the termination. The amount may include a reasonable allowance for profit on work done. However, the agreed amount, whether under this paragraph (f) or paragraph (g) of this clause, exclusive of costs shown in subparagraph (g)(3) of this clause, may not exceed the total contract price as reduced by (1) the amount of payments previously made and (2) the contract price of work not terminated. The contract shall be modified, and the Contractor paid the agreed amount. Paragraph (g) of this clause shall not limit, restrict, or affect the amount that may be agreed upon to be paid under this paragraph.

(g) If the Contractor and Contracting Officer fail to agree on the whole amount to be paid the Contractor because of the termination of work, the Contracting Officer shall pay the Contractor the amounts determined as

follows, but without duplication of any amounts agreed upon under paragraph (f) of this clause:

(1) For contract work performed before the effective date of termination, the total (without duplication of any items) of--

(i) The cost of this work;

(ii) The cost of settling and paying termination settlement proposals under terminated subcontracts that are properly chargeable to the terminated portion of the contract if not included in subdivision (g)(1)(i) of this clause; and

(iii) A sum, as profit on subdivision (g)(1)(i) of this clause, determined by the Contracting Officer under 49.202 of the Federal Acquisition Regulation, in effect on the date of this contract, to be fair and reasonable; however, if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, the Contracting Officer shall allow no profit under this subdivision (iii) and shall reduce the settlement to reflect the indicated rate of loss.

(2) The reasonable costs of settlement of the work terminated, including--

(i) Accounting, legal, clerical, and other expenses reasonably necessary for the preparation of termination settlement proposals and supporting data;

(ii) The termination and settlement of subcontracts (excluding the amounts of such settlements); and

(iii) Storage, transportation, and other costs incurred, reasonably necessary for the preservation, protection, or disposition of the termination inventory.

(h) Except for normal spoilage, and except to the extent that the Government expressly assumed the risk of loss, the Contracting Officer shall exclude from the amounts payable to the Contractor under paragraph (g) of this clause, the fair value, as determined by the Contracting Officer, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the Government or to a buyer.

(i) The cost principles and procedures of Part 31 of the Federal Acquisition Regulation, in effect on the date of this contract, shall govern all costs claimed, agreed to, or determined under this clause.

(j) The Contractor shall have the right of appeal, under the Disputes clause, from any determination made by the Contracting Officer under paragraph (e), (g), or (1) of this clause, except that if the Contractor failed to submit the termination settlement proposal or request for equitable adjustment within the time provided in paragraph (e) or (1), respectively, and failed to request a time extension, there is no right of appeal.

(k) In arriving at the amount due the Contractor under this clause, there shall be deducted--

(1) All unliquidated advance or other payments to the Contractor under the terminated portion of this contract;

(2) Any claim which the Government has against the Contractor under this contract; and

(3) The agreed price for, or the proceeds of sale of, materials, supplies, or other things acquired by the Contractor or sold under the provisions of this clause and not recovered by or credited to the Government.

(l) If the termination is partial, the Contractor may file a proposal with the Contracting Officer for an equitable adjustment of the price(s) of the continued portion of the contract. The Contracting Officer shall make any equitable adjustment agreed upon. Any proposal by the Contractor for an equitable adjustment under this clause shall be requested within 90

days from the effective date of termination unless extended in writing by the Contracting Officer.

(m)(1) The Government may, under the terms and conditions it prescribes, make partial payments and payments against costs incurred by the Contractor for the terminated portion of the contract, if the Contracting Officer believes the total of these payments will not exceed the amount to which the Contractor will be entitled.

(2) If the total payments exceed the amount finally determined to be due, the Contractor shall repay the excess to the Government upon demand, together with interest computed at the rate established by the Secretary of the Treasury under 50 U.S.C. App. 1215(b)(2). Interest shall be computed for the period from the date the excess payment is received by the Contractor to the date the excess is repaid. Interest shall not be charged on any excess payment due to a reduction in the Contractor's termination settlement proposal because of retention or other disposition of termination inventory until 10 days after the date of the retention or disposition, or a later date determined by the Contracting Officer because of the circumstances.

(n) Unless otherwise provided in this contract or by statute, the Contractor shall maintain all records and documents relating to the terminated portion of this contract for 3 years after final settlement. This includes all books and other evidence bearing on the Contractor's costs and expenses under this contract. The Contractor shall make these records and documents available to the Government, at the Contractor's office, at all reasonable times, without any direct charge. If approved by the Contracting Officer, photographs, microphotographs, or other authentic reproductions may be maintained instead of original records and documents.

(End of clause)

109 52.249-10 DEFAULT (FIXED-PRICE CONSTRUCTION) (APR 1984)

(a) If the Contractor refuses or fails to prosecute the work or any separable part, with the diligence that will insure its completion within the time specified in this contract including any extension, or fails to complete the work within this time, the Government may, by written notice to the Contractor, terminate the right to proceed with the work (or the separable part of the work) that has been delayed. In this event, the Government may take over the work and complete it by contract or otherwise, and may take possession of and use any materials, appliances, and plant on the work site necessary for completing the work. The Contractor and its sureties shall be liable for any damage to the Government resulting from the Contractor's refusal or failure to complete the work within the specified time, whether or not the Contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the Government in completing the work.

(b) The Contractor's right to proceed shall not be terminated nor the Contractor charged with damages under this clause, if-

(1) The delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include (i) acts of God or of the public enemy, (ii) acts of the Government in either its sovereign or contractual capacity, (iii) acts of another Contractor in the performance of a contract with the Government, (iv) fires, (v) floods, (vi) epidemics, (vii) quarantine restrictions, (viii) strikes, (ix) freight embargoes, (x) unusually severe weather, or (xi) delays of

subcontractors or suppliers at any tier arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and the subcontractors or suppliers; and

(2) The Contractor, within 10 days from the beginning of any delay (unless extended by the Contracting Officer), notifies the Contracting Officer in writing of the causes of delay. The Contracting Officer shall ascertain the facts and the extent of delay. If, in the judgment of the Contracting Officer, the findings of fact warrant such action, the time for completing the work shall be extended. The findings of the Contracting Officer shall be final and conclusive on the parties, but subject to appeal under the Disputes clause.

(c) If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the Government.

(d) The rights and remedies of the Government in this clause are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

110 52.252-6 AUTHORIZED DEVIATIONS IN CLAUSES (APR 1984)

(a) The use in this solicitation or contract of any Federal Acquisition Regulation (48 CFR Chapter 1) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the date of the clause.

(b) The use in this solicitation or contract of any DFARS (48 CFR Chapter 2) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the name of the regulation.

(End of clause)

(NM)

111 52.253-1 COMPUTER GENERATED FORMS (JAN 1991)

(a) Any data required to be submitted on a Standard or Optional Form prescribed by the Federal Acquisition Regulation (FAR) may be submitted on a computer generated version of the form, provided there is no change to the name, content, or sequence of the data elements on the form, and provided the form carries the Standard or Optional Form number and edition date.

(b) Unless prohibited by agency regulations, any data required to be submitted on an agency unique form prescribed by an agency supplement to the FAR may be submitted on a computer generated version of the form provided there is no change to the name, content, or sequence of the data elements on the form and provided the form carries the agency form number and edition date.

(c) If the Contractor submits a computer generated version of a form that is different than the required form, then the rights and obligations of the parties will be determined based on the content of the required form.

(End of clause)

112 52.232-34 OPTIONAL INFORMATION FOR ELECTRONIC FUNDS TRANSFER PAYMENT (AUG 1996)

(a) Method of payment.

(1) Except as provided in paragraph (a)(2) of this clause, after the Contractor provides the information described in paragraph (d) of this clause, in accordance with paragraph (b) of this clause, payments by the Government under this contract, including invoice and contract financing payments, may be made by check or electronic funds transfer (EFT) at the option of the Government. If payment is made by EFT, the Government may, at its option, also forward the associated payment information by electronic transfer. As used in this clause, the term "EFT" refers to the funds transfer and may also include the information transfer.

(2) Notwithstanding the provision of this clause making the furnishing of EFT information optional, the Contractor shall furnish the EFT information described in paragraph (d) for any payment to be made after January 1, 1999.

(b) Contractor consent.

(1) If the Contractor is willing to be paid by EFT, the Contractor shall provide the EFT information described in paragraph (d) of this clause. The Contractor agrees that, after providing EFT information in accordance with this clause, the Contractor cannot withdraw the Government's right to make payment by EFT for this contract.

(2) If the Contractor provides EFT information applicable to multiple contracts, the Contractor shall specifically state the applicability of this EFT information in terms acceptable to the payment office.

(c) Contractor's EFT information. Prior to submission of the first request for payment (whether for invoice or contract financing payment) under this contract, for which the Contractor desires EFT payment, the Contractor shall provide the information required to make contract payment by EFT, as described in paragraph (d) of this clause, directly to the Government payment office named in this contract. If more than one payment office is named for the contract, the Contractor shall provide a separate notice to each office. In the event that the EFT information changes, the Contractor shall be responsible for providing the changed information to the designated payment office(s).

(d) Required EFT information. The Government may make payment by EFT through either an Automated Clearing House (ACH) subject to the domestic banking laws of the United States or the Federal Reserve Wire Transfer System at the Government's option. The Contractor shall provide the following information for both methods in a form acceptable to the designated payment office. The Contractor may supply this data for this or multiple contracts (see paragraph (b) of this clause).

(1) The contract number to which this notice applies.

(2) The Contractor's name and remittance address, as stated in the contract, and account number at the Contractor's financial agent.

(3) The signature (manual or electronic, as appropriate), title, and telephone number of the Contractor official authorized to provide this information.

(4) For ACH payment only:

(i) Name, address, and 9-digit Routing Transit Number of the Contractor's financial agent.

(ii) Contractor's account number and the type of account (checking, saving, or lockbox).

(5) For Federal Reserve Wire Transfer System payments only:

(i) Name, address, telegraphic abbreviation, and the 9-digit Routing Transit Number for the Contractor's financial agent.

(ii) If the Contractor's financial agent is not directly on-line to the Federal Reserve Wire Transfer System and, therefore, not the receiver of the wire transfer payment, the Contractor shall also

provide the name, address, and 9-digit Routing Transit Number of the correspondent financial institution receiving the wire transfer payment.

(e) Suspension of payment.

(1) Notwithstanding the provisions of any other clause of this contract, if, after receipt of the Contractor's EFT information in accordance with paragraph (b) of this clause, the EFT information is found to be incorrect, or, for payment after January 1, 1999, if EFT information has not been furnished, then until receipt by the designated payment office of the correct EFT information from the Contractor, (i) the Government is not required to make any further payment under this contract; and (ii) any invoice or contract financing request shall be deemed not to be a valid invoice or contract financing request as defined in the Prompt Payment clause of this contract.

(2) If the EFT information changes after submission of correct EFT information, the Government shall begin using the changed EFT information no later than the 30th day after its receipt to the extent payment is made by EFT. However, the Contractor may request that no further payments be made until the changed EFT information is implemented by the payment office. If such suspension would result in a late payment under the Prompt Payment clause of this contract, the Contractor's request for suspension shall extend the due date for payment by the number of days of the suspension.

(f) Contractor EFT arrangements. The Contractor shall designate a single financial agent capable of receiving and processing the electronic funds transfer using the EFT methods described in paragraph (d) of this clause. The Contractor shall pay all fees and charges for receipt and processing of transfers.

(g) Liability for uncompleted or erroneous transfers.

(1) If an uncompleted or erroneous transfer occurs because the Government failed to use the Contractor-provided EFT information in the correct manner, the Government remains responsible for (i) making a correct payment, (ii) paying any prompt payment penalty due, and (iii) recovering any erroneously directed funds.

(2) If an uncompleted or erroneous transfer occurs because Contractor-provided EFT information was incorrect at the time of Government release of the EFT payment transaction instruction to the Federal Reserve System, and--

(i) If the funds are no longer under the control of the payment office, the Government is deemed to have made payment and the Contractor is responsible for recovery of any erroneously directed funds; or

(ii) If the funds remain under the control of the payment office, the Government retains the right to either make payment by mail or suspend the payment in accordance with paragraph (e) of this clause.

(h) EFT and prompt payment.

(1) A payment shall be deemed to have been made in a timely manner in accordance with the Prompt Payment clause of this contract if, in the EFT payment transaction instruction given to the Federal Reserve System, the date specified for settlement of the payment is on or before the prompt payment due date, provided the specified payment date is a valid date under the rules of the Federal Reserve System.

(2) When payment cannot be made by EFT because of incorrect EFT information provided by the Contractor, no interest penalty is due after the date of the uncompleted or erroneous payment transaction, provided that notice of the defective EFT information is issued to the Contractor within 7 days after the Government is notified of the defective EFT

information.

(i) EFT and assignment of claims. If the Contractor assigns the proceeds of this contract as provided for in the Assignment of Claims clause of this contract, the assignee shall provide the assignee EFT information required by paragraph (d) of this clause. In all respects, the requirements of this clause shall apply to the assignee as if it were the Contractor. EFT information which shows the ultimate recipient of the transfer to be other than the Contractor, in the absence of a proper assignment of claims acceptable to the Government, is incorrect EFT information within the meaning of paragraph (e) of this clause.

(j) Payment office discretion. If, after submitting the EFT information, the Contractor does not wish to receive payment by EFT methods for one or more payments, the Contractor may submit a request to the designated payment office to refrain from using the EFT payment method. The decision to grant the request is solely that of the Government.

(k) Change of EFT information by financial agent. The Contractor agrees that the Contractor's financial agent may notify the Government of a change to the routing transit number, Contractor account number, or account type. The Government shall use the changed data in accordance with paragraph (e)(2) of this clause. The Contractor agrees that the information provided by the agent is deemed to be correct information as if it were provided by the Contractor. The Contractor agrees that the agent's notice of changed EFT data is deemed to be a request by the Contractor in accordance with paragraph (e)(2) that no further payments be made until the changed EFT information is implemented by the payment office.

(End of clause)

AM #1 113 DELETED

114 52.222-21 PROHIBITION OF SEGREGATED FACILITIES (APR 1984)
(DEVIATION)

(a) "Segregated facilities," as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex or national origin because of written or oral policies, or employee custom. The term does not include separate or single-user rest rooms and necessary dressing or sleeping areas, which shall be provided to assure privacy between the sexes.

(b) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Opportunity clause in this contract.

(c) The Contractor shall include this clause in every subcontract that contains the clause of this contract entitled "Equal Opportunity."
(End of clause)

END OF SECTION 00700

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SECTION 00800
SPECIAL CONTRACT REQUIREMENTS

1 52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984)

The Contractor shall be required to (a) commence work under this contract within ten (10) calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than the dates or the number of calendar days set forth in Section 01000 CONSTRUCTION SCHEDULE. The time stated for completion shall include final cleanup of the premises.
(End of clause)

2 52.0-4039 YEAR 2000 COMPLIANCE (JULY 1998)

~~AM #1 Year 2000 Compliance:~~

~~1. "Year 2000 compliant," means, with respect to information technology, that the information technology accurately processes date/time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000 and leap year calculations, to the extent that other information technology, used in combination with the information technology being acquired, properly exchanges date/time data with it.~~

~~2. In accordance with FAR 39.106, the contractor shall ensure that with respect to any design, construction, goods, or services under this contract as well as any subsequent task/delivery orders issued under this contract (if applicable), all information technology contained therein shall be Year 2000 compliant. Specifically the contractor shall:~~

~~a. Perform, maintain, and provide an inventory of all major components to include structures, equipment, items, parts, and furnishings under this contract and each task/delivery order that may be affected by the Y2K compliance requirement.~~

~~b. Indicate whether each component is currently Year 2000 compliant or requires an upgrade for compliance prior to government acceptance.~~

~~3. Warranty: The Contractor warrants that all hardware, software, or firmware product maintained under this contract shall be Year 2000 compliant. If the contract requires that specific listed products must perform as a system in accordance with the foregoing warranty, then that warranty shall apply to those listed products as a system. The duration of this warranty and the remedies available to the Government for breach of this warranty shall be as defined in, and subject to, the terms and limitation of the contractor's standard commercial warranty or warranties contained in this contract provided that notwithstanding any provisions to the contrary in such commercial warranty or warranties, the remedies available to the Government under this warranty shall include repair or replacement of any listed product whose non-compliance is discovered and made known to the contractor in writing within ninety (90) days after~~

~~acceptance. Nothing in this warranty shall be construed to limit any rights or remedies the Government may otherwise have under this contract with respect to defects other than Year 2000 performance.~~

(End of Paragraph)

3 52.0-4083 CORRESPONDENCE IDENTIFICATION (52.0000-4083)

a. The Contractor shall use a serial numbering system on all formal correspondence sent to the Contracting Officer or his representative. The Contractor will provide one original and two duplicate copies of all correspondence.

b. The Contractor may use a Request for Information (RFI) system for drawing/specification clarifications, subject to the following conditions:

(1) The Contractor shall use a sequential numbering system for all RFI's separate and apart from the correspondence numbering system.

(2) The Contractor shall provide one original and two copies of all RFI's.

(3) The Contractor shall designate ONE individual responsible person, subject to approval by the Contracting Officer, for reviewing and issuing RFI's.

(4) If a Network Analysis is required, all RFI's are to identify the NAS activities directly and/or indirectly affected by the RFI on the progress schedule. The Contractor should anticipate a minimum of 10 calendar days for Government review and response.

(5) No requests for deviations or variations from the contract by RFI will be allowed. Deviations/variatiions are to be submitted on ENG Form 4025 as described in Section 01300, SUBMITTAL PROCEDURES.

(6) The use of RFI's does not relieve the Contractor of his responsibility for reviewing the contract documents and coordinating the work to be performed. If it is determined by the Contracting Officer that the RFI system is being used for other than its intended purpose, the Contracting Officer has the authority to discontinue the use of the RFI's for the remainder of the contract.

(End of Statement)

4 52.1-4038 196 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER (OCT 1989) (ER 415-1-15) (52.0001-4038 1/96)

a. This provision specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the Contract Clause entitled "DEFAULT (FIXED PRICE CONSTRUCTION)". In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

(1) The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

(2) The unusually severe weather must actually cause a delay to completion of the project. The delay must be beyond the control and without the fault or negligence of the contractor.

b. The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER CALENDAR DAYS
WORK DAYS BASED ON (5) DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	1	1	1	2	1	3	3	2	1	1	2

c. Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the contract, the contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the contractor's scheduled work day. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph "b" above, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the contract clause entitled "DEFAULT (FIXED PRICE CONSTRUCTION)." (END)

5 52.1-4050 196 PROCUREMENT AUTHORITY FOR FEDERAL INFORMATION RESOURCES

Pursuant to the Federal Information Resources Management Regulation (FIRMR), Section 201-39.5202-3, this acquisition is not being conducted under the FIRMR, however any modifications requiring Federal Information Processing (FIP) resources will be conducted under specific agency delegation of GSA's exclusive procurement authority for FIP resources. The specific GSA DPA case number is KAA-95-AD-012.

6 52.1-4063 VALUE ENGINEERING CONTRACTOR PROPOSAL - VECP (AUG 86)
(52.0001-4063)

a. Reference the Contract Clause "VALUE ENGINEERING-CONSTRUCTION".

b. After receipt of an approved VECP modification signed by the Contracting Officer, the Contractor may include its share of the Instant Contract Savings as part of the next scheduled Progress Payment estimate.

c. Payment of the Contractor's share of the Instant Contract Savings may be withheld at the discretion of the Contracting Officer, until a revised NAS or BAR CHART for the affected activity has been submitted and approved.

(End of Clause)

7 52.211-4406 196 LIQUIDATED DAMAGES--CONSTRUCTION (APR 1984) (52.0211-4406
1/96)

(a) If the Contractor fails to complete the work within the time specified in the contract, or any extension thereof, the Contractor shall pay to the Government as liquidated damages, the sum for each day of delay as set forth in the schedule given in Section 1000, "CONSTRUCTION SCHEDULE".

(b) If the Government terminates the Contractor's right to proceed, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the Government in completing the work.

(c) If the Government does not terminate the Contractor's right to proceed, the resulting damage will consist of liquidated damages until the work is completed or accepted.

(End of Clause)

8 52.228-12 PROSPECTIVE SUBCONTRACTOR REQUESTS FOR BONDS (OCT 1995)

In accordance with Section 806(a)(3) of Pub. L. 102-190, as amended by Sections 2091 and 8105 of Pub. L. 103-355, upon the request of a prospective subcontractor or supplier offering to furnish labor or material for the performance of this contract for which a payment bond has been furnished to the Government pursuant to the Miller Act, the Contractor shall promptly provide a copy of such payment bond to the requester.

(End of clause)

9 52.228-4005 L1 REQUIRED INSURANCE (APR 1984) (52.0228-4005 L1)

As a minimum and pursuant to contract clause entitled "Insurance--Work on a Government Installation", the contractor shall maintain the following insurance.

(a) Workmen's compensation and employers' liability insurance in compliance with applicable state statutes, with a minimum employers' liability coverage of \$100,000.

(b) Comprehensive general liability insurance for bodily injury in the minimum limits of \$500,000 per occurrence. No property damage liability insurance is required.

(c) Comprehensive automobile liability insurance covering the operation of all automobiles used in connection with the performance of the contract in the minimum limits of \$200,000 per person and \$500,000 per occurrence for bodily injury and \$20,000 per occurrence for property damage.

11 52.231-5000 efr EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE (MAR 1995) (EFARS 31.105(d)(2)(I)(B)) (52.231-5000 efr)

(a) This statement shall become operative only for negotiated contracts where cost or pricing data is requested, and for modifications to sealed bid or negotiated contracts where cost or pricing data is requested. This clause does not apply to terminations. See 52.249-5000, Basis for settlement of proposals and FAR Part 49.

(b) Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the contractor's accounting records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule, Region VI. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the contracting officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retroactive pricing, the schedule in effect at the time the work was performed shall apply.

(c) Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements, will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.

(d) When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the contracting officer shall request the contractor to submit either certified cost or pricing data, or partial/limited data, as appropriate. The data shall be submitted on Standard Form 1411, Contract Pricing Proposal Cover Sheet.

(End of clause)

12 52.232-5000 efr PAYMENT FOR MATERIALS DELIVERED OFFSITE (MAR 1995) (EFARS 52.232-5000) efr

(a) Pursuant to FAR clause 52.232-5, Payments Under Fixed Priced Construction Contracts, materials delivered to the contractor at locations other than the site of the work may be taken into consideration in making payments if included in payment estimates and if all the conditions of the General Provisions are fulfilled. Payment for items delivered to locations other than the work site will be limited to: (1) materials required by the technical provisions; or (2) materials that have been fabricated to the point where they are identifiable to an item of work required under this contract.

(b) Such payment will be made only after receipt of paid or receipted invoices or invoices with canceled check showing title to the items in the prime contractor and including the value of material and labor incorporated into the item. In addition to petroleum products, payment for materials delivered off-site is limited to the following items: None.

(End of clause)

13 52.236-14 AVAILABILITY AND USE OF UTILITY SERVICES (APR 1984)

(a) The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

(b) The Contractor, at its expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

(End of clause)

(R 7-603.30 1967 APR)

(R 7-2102.4 1976 OCT)

14 52.236-4001 EBS CONTRACT DRAWINGS, MAPS, AND SPECIFICATIONS (OCT 1996)
(52.0236-4001 EBS)

(a) The Government--

(1) Will provide the Contractor, without charge, one set of contract drawings and one set of specifications in electronic format on a compact disk. It is the contractor's responsibility to reproduce a set of contract drawings from this compact disk. The Government will not give the contractor any hard copy paper drawings or specifications for any contract resulting from this solicitation.

(b) The Contractor shall--

(1) Check all drawings furnished immediately upon receipt;

(2) Compare all drawings and verify the figures before laying out the work;

(3) Promptly notify the Contracting Officer of any discrepancies; and

(4) Be responsible for any errors which might have been avoided by complying with this paragraph (b).

(c) Large scale drawings shall, in general, govern small scale drawings. Figures marked on drawings shall, in general, be followed in preference to scale measurements.

(d) Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work, but shall be performed as if fully and correctly set forth and described in the drawings and specifications.

(e) The work shall conform to the specifications and the contract drawings identified on the following index of drawings:

CONTRACT DRAWINGS

AMMO SUPPLY POINT IMPROVEMENTS				
AT				
MCGREGOR RANGE, NEW MEXICO				
FORT BLISS, TEXAS				
Sequence:	:	:	:	:
No. :	Title	:	Drawing No.	:
				Sheet No.

The list of drawings and maps set out in the index on the drawings is hereby incorporated by reference into these specifications.

Schedules included in the drawings are for the purpose of defining requirements other than quantities.

(End of clause)

15 52.236-4004 196 PHYSICAL DATA (APR 1984) (52.0236-4004 196)

Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

a. The physical conditions indicated on the drawings and in the specifications are the result of site investigations by surveys and borings.

b. Ground Water Levels

It has been observed that ground water levels in heavily timbered or grassed areas quite often undergo a significant temporary rise when the area is cleared and/or stripped. This increase in water level can hinder traffic and construction progress in the affected areas. The duration of the ground water rise varies considerably, depending on prevailing weather and/or climatic conditions. Ref: Yearbook of Agriculture, 1957, copy available for inspection in Fort Worth District Office.

(End of clause)
(R 7-603.25 1965 JAN)

16 52.236-4005 I SALVAGE MATERIALS AND EQUIPMENT (JAN 1965) (52.0236-4005)

The Contractor shall maintain adequate property control records for all materials or equipment specified to be salvaged. These records may be in accordance with the Contractor's system of property control, if approved by the property administrator. The contractor shall be responsible for the adequate storage and protection of all salvaged materials and equipment and shall replace, at no cost to the Government, all salvage materials and equipment which are broken or damaged during salvage operations as the result of his negligence, or while in his care.

17 52.236-4007 196 PAYMENT FOR UTILITY SERVICES (FAR 36.303(c)(6)(52.0236-4007 196)

In accordance with Contract Clause 52.236-14, "Availability and use of Utility Services," water, gas, and electricity are available from Government-owned and operated systems and will be charged to the Contractor at rates as provided in the paragraph "Availability and Use of Utility Services".

(End of clause)

18 52.249-5000 efr BASIS FOR SETTLEMENT OF PROPOSALS

"Actual costs will be used to determine equipment costs for a settlement proposal submitted on the total cost basis under FAR 49.206-2(b). In evaluating a terminations settlement proposal using the total cost basis, the following principles will be applied to determine allowable equipment costs:

(1) Actual costs for each piece of equipment, or groups of similar serial or series equipment, need not be available in the contractor's accounting records to determine total actual equipment costs.

(2) If equipment costs have been allocated to a contract using predetermined rates, those charges will be adjusted to actual costs.

(3) Recorded job costs adjusted for unallowable expenses will be used to determine equipment operating expenses.

(4) Ownership costs (depreciation) will be determined using the contractor's depreciation schedule (subject to the provisions of FAR 31.205-11).

(5) License, taxes, storage and insurance costs are normally recovered as an indirect expense and unless the contractor charges these costs directly to contracts, they will be recovered through the indirect expense rate."

(End of Statement)

19 52.236-4201 PERFORMANCE EVALUATION OF CONTRACTOR (52.0236-4201)

a. As a minimum, the Contractor's performance will be evaluated upon final acceptance of the work. However, interim evaluations (per delivery order, per quarter, etc.) may be prepared at any time during contract performance when determined to be in the best interest of the Government.

b. The format for the evaluation will be Department of Defense (DD) Form 2626. The Contractor will be rated either outstanding, above average, satisfactory, marginal, or unsatisfactory in the areas of Contractor Quality Control, Timely Performance, Effectiveness of Management, Compliance with Labor Standards, and Compliance with Safety Standards. The Contractor will be advised in writing of an overall unsatisfactory rating prior to completing the evaluation.

c. In accordance with Defense Federal Acquisition Regulation Supplement (DFARS) 236.201(c)(2), all performance evaluations will be made available to all DoD Contracting offices for their future use in determining contractor responsibility.

(End of Paragraph)

END OF SECTION 00800

GUIDE SPECIFICATION FOR MILITARY CONSTRUCTION

SECTION 01510 - ENVIRONMENTAL PROTECTION [AMEND 0001]

PART 1. - GENERAL

This guide specification covers the requirements to ensure environmental protection of the air, water, and land in relation to construction activities associated with the relocation of the Ammunition Supply Point (ASP) from the Fort Bliss Main Post Area to the McGregor Range. Based on existing site information, the presence of hazardous substances are not currently anticipated.

1.1. SUMMARY

The work covered by this section consists of furnishing all labor, materials and equipment and performing all work required for the prevention of environmental pollution during and as the result of construction operations under this contract except for those measures set forth in other Technical Provisions of these specifications. For the purpose of this specification, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic and recreational purposes. The control of environmental pollution requires consideration of air, water, and land, and involves noise, solid waste management and management of radiant energy and radioactive materials, as well as other pollutants.

1.2. REFERENCES

The publications listed below form a part of this section to the extent referenced. The publications are referenced in the text by basic designation only.

CORPS OF ENGINEERS (COE)

\-COE EM 385-1-1-\ (Latest Version) Safety and Health Requirements Manual

CODE OF FEDERAL REGULATIONS (CFR)

\-40 CFR 82-\ Protection of Stratospheric Zone

\-40 CFR 301-312-\ Emergency Planning and Community Right-To-Know Act (EPCRA) Also known as Superfund Amendments and Reauthorization Act (SARA) Title II

\-40 CFR 302-\ Designation, Reportable Qualities, and Notification

\-40 CFR 370-\ Hazards Chemical Reporting: Community Right-To-Know

1.3. SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with guide specification CEGS-01330 SUBMITTAL PROCEDURES.

Temporary Field Structures\; *GA*\

The Contractor shall submit for approval drawings showing the locations, details, and landscaping plans for all temporary field structures, including field office, storage and other construction buildings, roads, embankments, and excavations. See PART 3 paragraphs "Location of Temporary Field Offices, Storage, and Other Construction Buildings" and "Temporary Excavation and Embankments."

Environmental Protection Proposals\; *GA*\

Prior to commencement of the work the Contractor shall submit in writing his environmental protection proposals for implementing the provisions of this section and other sections of these specifications for environmental pollution control. The Contractor shall address by separate submittals the plans to prevent and control each of the following: (a) soil contamination, (b) water pollution, and (c) dust control.

Pest Control Personnel\; *GA*\

Prior to application of pesticides, the Contractor shall submit the qualifications and state certification of pest control personnel who will apply the pesticides and the proposed delivery, storage, application, and disposal procedures.

Storm Water Pollution Prevention Plan\; *GA*\

Submit a copy of the Contractor's Pollution Prevention Plan (SWPPP) developed in accordance with PART 3 paragraph "Storm Water Pollution Prevention Plan" and the Environmental Protection Agency's storm water discharge regulations.

Hazardous Substance Reporting\; *FIO*\

The Contractor shall submit a copy of the attached Emergency Planning and Community Right to Know notification and other reports to the Contracting Officer and to the Facility Emergency Coordinator (FEC) as specified in PART 3 paragraph EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW REQUIREMENTS.

1.4. IMPLEMENTATION MEETING

Prior to commencement of the work the Contractor shall meet with representatives of the Contracting Officer to develop mutual understandings relative to compliance with these provisions and administration of the environmental pollution control program.

1.5. APPLICABLE REGULATIONS

In order to prevent, and to provide for abatement and control of, any environmental pollution arising from the construction activities of the Contractor and his subcontractors in the performance of this contract, they shall comply with all applicable Federal, State, and local laws and regulations concerning environmental pollution control and abatement, and all applicable provisions of the \-COE EM 385-1-1-\, entitled "Safety and Health Requirements Manual," as well as the specific requirements stated in this section and elsewhere in the contract specifications. Applicable State of New Mexico Solid Waste Management (NMSWM) regulations and New Mexico Water Quality Control Commission (NMWQCC) regulations shall also be adhered to.

1.6. NOTIFICATION OF NON-COMPLIANCE

The Contracting Officer will notify the Contractor in writing of any observed non-compliance with the foregoing provisions. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it was later determined that the Contractor was in compliance.

1.7. SUBCONTRACTORS

Compliance with the provisions of this section by subcontractors will be the responsibility of the Contractor.

PART 2. - PRODUCTS (Not Applicable)

PART 3. - EXECUTION

3.1. PROTECTION OF LAND RESOURCES

The land resources within the property of the Government but outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction that will appear to be natural and not detract from the appearance of the project. Insofar as possible, the Contractor shall confine his construction activities to areas defined by the plans or specifications, to areas to be cleared for other operations, or to borrow or waste areas indicated on the plans. At the onset of borrow excavation, topsoil shall be saved for use in restoring the borrow area. Waste and borrow areas shall be leveled or trimmed to regular lines and shaped to provide a neat appearance. In all instances the restored area shall be well drained, so as to prevent the accumulation of stagnant water. The following additional requirements are intended to supplement and clarify the requirements of Contract Clauses entitled Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements; Operations and Storage Areas; and Cleaning Up.

3.1.1. Prevention of Landscape Defacement

Except in areas shown on the plans or specified to be cleared, the Contractor shall not deface, injure, or destroy trees or shrubs, nor remove or cut them without special authority from the Contracting Officer. Trees designated to be saved shall be protected from either excavation or filling within the root zone closer than the normal drip line of the tree. No ropes, cables, or guys shall be fastened to or attached to any existing trees for anchorages unless specifically authorized by the Contracting Officer. Where such special emergency use is permitted, the Contractor shall first adequately wrap the trunk with a sufficient thickness of burlap or rags over which softwood cleats shall be tied before any rope, cable, or wire is placed. The Contractor shall in any event be responsible for any damage resulting from such use. Where, in the opinion of the Contracting Officer, trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or by his blasting, dumping, or other operations, he may direct the Contractor to protect adequately such trees by placing boards, planks, or poles around them. When earthwork operations are liable, in the opinion of the Contracting Officer, to cause rock to roll or otherwise be displaced into uncleared areas, the Contractor shall construct barriers to protect the trees. Rocks that are displaced into uncleared areas shall be removed. Monuments, markers, and works of art shall be protected similarly before beginning operations near them.

3.1.2. Restoration of Landscape Damage

Any trees or other landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense. The Contracting Officer will decide what method of restoration shall be used, and whether damaged trees shall be treated or removed and disposed of under requirements for clearing and grubbing. All scars made on trees (not designated on the plans to be removed) by equipment, construction operations, or by the removal of limbs larger than 25 mm (1 inch) in diameter shall be coated as soon as possible with an approved tree wound dressing. All trimming or pruning shall be performed in an approved manner by experienced workmen with saws or pruning shears. Tree trimming with axes will not be permitted. Where tree climbing is necessary, the use of climbing spurs will not be permitted. The use of climbing ropes will be required by the Contracting Officer where deemed necessary for safety. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the Contractor and are beyond saving in the opinion of the Contracting Officer, shall be immediately removed and replaced with a nursery-grown tree of the same species and size approved by the Contracting Officer.

3.1.3. Location of Temporary Field Offices, Storage, and Other Construction Buildings

The location on Government property of the Contractor's temporary field office, storage, and other construction buildings, required temporarily in the performance of the work, shall be upon cleared portions of the job site or areas to be cleared, and shall require written approval of the Contracting Officer. The preservation of the landscape shall be an imperative consideration in the selection of all sites and in the construction of buildings. Contractor plans showing temporary field office, storage, and other construction buildings shall be submitted for approval of the Contracting Officer. Where buildings or tent platforms are constructed on sidehills, the Contracting Officer may require cribbing to be used to obtain level foundations. Benching or leveling of earth may not be allowed, depending on the location of the proposed facility.

3.1.4. Temporary Excavation and Embankments

If the Contractor proposes to construct temporary roads or embankments and excavations for plant and/or work areas, he shall submit the following for approval at least thirty (30) days prior to scheduled start of such temporary work:

- a. A layout of all temporary roads, excavations, and embankments to be constructed within the work area.
- b. Details of road construction and stabilization.
- c. Details of the completed borrow excavation.
- d. Plans and cross sections of proposed embankments and their foundations, including a description of proposed materials and methods of embankment stabilization.
- e. A landscaping plan showing the proposed restoration of the area. Removal of any necessary trees and shrubs outside the limits of required clearing, borrow, or waste areas

shall be indicated. The plan shall also indicate location of required guard posts or barriers required to control vehicular traffic passing close to trees and shrubs to be maintained undamaged. The plan shall provide for the obliteration of construction scars as such and shall provide for a reasonably natural appearing final condition of the area. Modification of the Contractor's plans shall be made only with the written approval of the Contracting Officer. No unauthorized road construction, excavation or embankment construction (including disposal areas) will be permitted.

3.1.5. Post-Construction Cleanup or Obliteration

The Contractor shall obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other vestiges of construction, as directed by the Contracting Officer.

It is anticipated that excavation, filling, and plowing of roadways will be required to restore the area to near natural conditions which will permit the growth of vegetation thereon. Restoration to original contours is not required.

3.2. PROTECTION OF THE STRATOSPHERIC OZONE

The Contractor shall comply with 40 CFR Part 82 "Protection of Stratospheric Ozone." To the maximum extent practicable, the Contractor shall choose safe alternatives and products made with or containing safe alternatives to Class I or II ozone depleting substances, identified under 42 U.S.C. 7671k. The Contractor shall screen the contract specifications and inform the Contracting Officers Representative when the specifications require the use of materials or equipment that use ozone depleting substances in their manufacture or operation so the Government can revise the guide specifications when appropriate.

3.3. PROTECTION OF HISTORICAL AND ARCHEOLOGICAL RESOURCES

3.3.1. Preservation of Existing Historical, Archeological, and Cultural Resources

As per discussions with relevant Fort Bliss personnel, there are no concerns of impacting historical, archeological, or cultural resources in the project area. However, potential archeological and cultural resources may be present in the surrounding vicinity. If additional information is necessary, contact Mr. Tim Bowman, Archeologist, Fort Bliss, Texas.

The Contractor shall take precautions during this contract to preserve all resources as they existed at the time of contract award. The Contractor shall install all protective devices such as off limits markings, fencing, barricades or other devices as designated on the contract drawings and shall be responsible for preservation of the sites during this contract.

3.3.2. Recording and Preserving Historical and Archeological Finds

All items having any apparent historical or archeological interest outside of designated areas which are discovered in the course of any construction activities shall be carefully preserved. The Contractor shall leave the archeological find undisturbed and shall flag an area of 15 meters (50 feet) radius around the find, and shall immediately report the find to the Contracting Officer so that the proper authorities may be notified. Any work required to preserve or protect these finds will be accomplished by change order under the clause entitled Changes of the CONTRACT CLAUSES.

3.4. PROTECTION OF WATER RESOURCES

The Contractor shall not pollute streams, lakes, or reservoirs with fuels, oils, bitumens, calcium chloride, acids, construction wastes, or other harmful materials. It is the responsibility of the Contractor to investigate and comply with all applicable Federal, State, County, and Municipal laws concerning pollution of rivers and streams. All work under this contract shall be performed in such a manner that objectionable conditions will not be created in lakes, reservoirs, or streams through or adjacent to the project areas. For construction sites less than 20,230 square meters (5 acres) in size and prior to start of construction, the Contractor shall submit to the Contracting Officer a plan showing his scheme for controlling erosion and disposing of wastes.

3.4.1. Storm Water Pollution Prevention Plan

For project sites greater than 20,230 square meters (5 acres) in size (including all temporary access roads, trailer sites, storage areas, and any other disturbed area associated with the project), the Contractor shall develop a Storm Water Pollution Prevention Plan (SWPPP) and complete a Notice of Intent (NOI) for Storm Water Discharges as required for an NPDES General Permit administered by the Environmental Protection Agency (EPA). The Contractor's detailed SWPPP shall be developed within the guidelines of the basic SWPPP provided as Attachment A to this section of the specifications. The Contractor shall submit his NOI to EPA not later than 48 hours prior to start of work. A dated copy of the Contractor's SWPPP and NOI shall be submitted to the Contracting Officer prior to commencement of construction activities. In addition, the Contractor shall post a copy of the Corps' NOI, the Contractor's NOI, and a brief project description on the project bulletin board. For the project description, the Contractor may use Section 1.1 of the SWPPP or write a brief description.

3.4.2. Erosion and Sediment Control

The Contractor shall plan (identify in SWPPP), construct, and install all temporary and permanent erosion sedimentation control measures. Disturbed areas shall be graded to control erosion. The area of bare soil exposed at any one time by construction operations shall be held to a minimum. Unless otherwise approved by the Contracting Officer, the Contractor shall stabilize denuded ground on any particular portion of the site within 14 days after construction activity has temporarily or permanently ceased, except for areas where construction activities will resume within 21 days from when construction activities ceased. Stabilization may be achieved with temporary seeding, mulching, geotextiles, vegetative buffer strips, or a combination of these methods. Stream crossings by fording with equipment shall be limited to control turbidity and in areas of frequent crossings temporary culverts or bridge structures shall be installed. Any temporary culverts or bridge structures shall be removed upon completion of the project. Fills and waste areas shall be constructed by selective placement to eliminate to the extent practicable silts or clays on the surface that will erode and contaminate adjacent streams or lakes.

3.5. SPILLAGES AND DISPOSAL OF WASTE MATERIALS

3.5.1. Spillages

Prevent chemicals, fuels, oils, greases, bituminous materials, waste washings, herbicides and insecticides, and cement from entering streams, rivers, or lakes

3.5.2. Disposal

No solid materials, including building material wastes, shall be disposed of at the construction site unless approved by the Contracting Officer. Disposal of any materials, wastes, effluents, trash, garbage, oil, grease, chemicals, etc., in areas adjacent to streams shall be subject to the approval of the Contracting Officer. If any waste material is dumped in unauthorized areas the Contractor shall remove the material and restore the area to the condition of the adjacent undisturbed area. If necessary, contaminated ground shall be excavated, disposed of as directed by the Contracting Officer, and replaced with suitable fill material, compacted and finished with topsoil all at the expense of the Contractor. Wastes shall be disposed of as specified below.

3.5.2.1 Solid Wastes

Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. Handling and disposal shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. The Contractor shall transport solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal.

3.5.2.2 Chemical Waste

Chemicals shall be dispensed ensuring no spillage to ground or surface water. Periodic inspections of dispensing areas to identify leakage and initiate corrective action shall be performed and documented. This documentation will be periodically reviewed by the Government. Chemical waste shall be collected in corrosion resistant, compatible containers. Collection drums shall be monitored and removed to a staging or storage area when contents are within 150 mm from the top. Wastes shall be disposed of in accordance with Federal, State, and local laws and regulations.

3.5.2.3 Hazardous Waste

The Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing and shall collect waste in suitable containers observing compatibility. The Contractor shall transport hazardous waste off Government property and dispose of it in compliance with Federal, State, and local laws and regulations. Spills of hazardous or toxic materials shall be immediately reported to the Contracting Officer. Cleanup of spills shall be the Contractor's responsibility.

3.6. PROTECTION OF FISH AND WILDLIFE

The Contractor shall at all times perform all work and take such steps required to prevent any interference or disturbance to fish and wildlife. The Contractor will not be permitted to alter water flows or otherwise disturb native habitat adjacent to the project area which, in the opinion of the Contracting Officer, are critical to fish or wildlife. Construction of check dams in live streams will not be permitted. Fouling or polluting of water will not be permitted. Wash waters and wastes shall be processed, filtered, ponded, or otherwise treated prior to their release into a river or other body of water.

3.7. JANITOR SERVICES

The Contractor shall furnish daily janitorial services for the temporary field office, storage, and other construction buildings on the project site and perform any required maintenance of facilities and grounds as deemed necessary by the Contracting Officer during the entire life of the contract. Toilet facilities shall be kept clean and sanitary at all times. Services shall be performed at such a time and in such a manner to least interfere with the operations but will be accomplished only when the buildings are occupied. Services shall be accomplished to the satisfaction of the Contracting Officer. The Contractor shall also provide daily trash collection and cleanup of the buildings and adjacent outside areas, snow removal in season, and shall dispose of all discarded debris and samples in a manner approved by the Contracting Officer.

3.8. BURNING

No material shall be burned at the project site unless otherwise specified in other sections of these specifications or authorized by the Contracting Officer.

3.8.1 DUST CONTROL

The Contractor will be required to maintain all excavations, embankments, stockpiles, haul roads, permanent access roads, plant sites, waste areas, borrow areas, and all other work areas within or without the project boundaries free from dust in accordance with all applicable local, state, and Federal regulations for the control of dust and particulate emissions. Approved temporary methods of stabilization consisting of water sprinkling, chemical treatment, light bituminous treatment or similar methods will be permitted to control dust. Sprinkling, to be approved, must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the Contractor must have sufficient competent equipment on the job to accomplish this if sprinkling is used. Dust control shall be performed as the work proceeds to minimize vehicle offsite tracking of sediment and generation of dust. Gravel paving or light bituminous treatment shall be provided for entrance and exit drives, parking areas, and unpaved roads carrying more than 25 vehicles per day on the construction site. See Section 01562 DUST CONTROL.

3.9. MAINTENANCE OF POLLUTION CONTROL FACILITIES DURING CONSTRUCTION

During the life of this contract the Contractor shall maintain all facilities constructed for pollution control under this contract as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created. During the construction period the Contractor shall conduct frequent training courses for his maintenance personnel. The curricula shall include methods of detection of pollution, familiarity with pollution standards, and installation and care of vegetation covers, plants, and other facilities to prevent and correct environmental pollution.

3.9.1. Storm Water Pollution Prevention Plan

For construction sites covered by a General Permit for Storm Water Discharges, the Contractor's quality control organization shall inspect pollution control structures and activities a minimum of once every seven calendar days and within 24 hours after any storm event of greater than 13 mm (1/2 inch) until final stabilization is achieved. A sample Inspection and Maintenance Report form is attached as Attachment B. An inspection report for each inspection shall be retained on site by the Contractor. In addition, the Contractor shall furnish a copy of each report to the Contracting Officer. When the inspection reveals inadequacies, the pollution prevention measures in the Contractor's Pollution Prevention Plan must be revised and changes implemented within seven days after the inspection. After final stabilization has been achieved, the Contractor shall inspect the site once a month until final inspection and project acceptance by the Corps. After project acceptance, the Contractor shall halt all inspections and shall independently submit a Notice of Termination (NOT) to EPA for the Contractor's General Permit.

3.10. PESTICIDES (INSECTICIDES, FUNGICIDES, HERBICIDES, ETC.)

The use of pesticides shall not be permitted unless approved by the contracting officer. Application of all pesticides shall be accomplished by certified pest control personnel or under the supervision of a certified pest control operator. Delivery and storage of pesticides will be monitored by certified personnel to insure the adequacy of containers and the safe storage of toxic materials. Disposal of containers and chemicals will be monitored to prevent pollution of natural drainage systems.

3.11. EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW REQUIREMENTS

The Contractor shall comply with the requirements of Sections 301 through 312 of the Emergency Planning and Community Right-to-Know Act (EPCRA), also known as Superfund Amendments and Reauthorization Act (SARA) Title III, as published in 40 CFR Part 355. The Contractor shall also comply with all state regulations and procedures which result from EPCRA and the hazard communication program requirements of 40 CFR 355.1. The following planning and reporting requirements involve the Contractor's reporting requirements but are not all inclusive; i.e. transport regulations are not addressed. It is the Contractor's responsibility to comply with all Federal, state, and local emergency planning and reporting requirements.

3.11.1. Definitions and Acronyms

3.11.1.1. CERCLA Hazardous Substance (CHS)

A CERCLA Hazardous Substance (CHS) is any substance listed in Section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act, also referred to as Superfund; the list of substances also appears in Table 302.4 of 40 CFR 302.

3.11.1.2. Contracting Officer (CO)

The Contracting Officer (CO) is the site owner or operator's construction representative.

3.11.1.3. Extremely Hazardous Substance (EHS)

An Extremely Hazardous Substance (EHS) is any substance listed in Appendices A and B of 40 CFR 355.

3.11.1.4. Facility Emergency Coordinator (FEC)

Facility Emergency Coordinator (FEC) is the representative of the facility Owner or Operator. The Contractor shall identify the FEC and notify the FEC as described below each time the Contractor brings a hazardous substance onto the construction site.

3.11.1.5. Hazardous Chemical Substance (HCS)

A Hazardous Chemical Substance (HCS) is any substance defined as hazardous under 29 CFR 1910.1200, with exceptions as listed in 40 CFR 370.2; generally any substance with a Material Safety Data Sheet (MSDS).

3.11.1.6. Reportable Quantity (RQ)

Reportable Quantity (RQ) is a specified minimum amount of a CHS or an EHS which, if released, must be reported immediately to the FEC. The RQ for a CHS is listed in Table 302.4 of 40 CFR 302; the RQ for an EHS is 0.45 kg (1 pound).

3.11.1.7. Threshold Planning Quantity (TPQ)

Threshold Planning Quantity (TPQ) is a specified minimum amount of an EHS which, if brought onto the construction site, must be reported within a stated time to the FEC. The TPQ for an EHS is listed in Appendices A and B of 40 CFR 355 or is the quantity published in state code, whichever is less.

3.12.2 Hazardous Substance Reporting

Whenever a HCS or an EHS substance is brought onto the construction site, the Contractor shall report and submit appropriate documentation to the FEC, the fire department with jurisdiction over the site, and the Contracting Officer as described below:

- a. within 5 days for an EHS substance which (1) equals or exceeds its TPQ, or (2) is a solid or liquid weighing 225 kg (500 pounds) or more, whichever is less, or
- b. within 10 days for a HCS substance which equals or exceeds 4,500 kg (10,000 pounds) for a solid or 208 liters (55 gallons) for a liquid.

3.12.3 Emergency Release Notification for Listed Hazardous Substances

The Contractor shall immediately notify the FEC and the Contracting Officer if there is a release of an EHS or a CHS substance whose quantity equals or exceeds its RQ.

3.12.3.1 Emergency Notification Information

Emergency notifications shall consist of the following information:

- a. The Contractor's name, the name and telephone number of the person making the report, and the name and telephone number of the Contractor's contact person;
- b. The chemical name and identification;
- c. An estimate of the quantity released;
- d. The location of the release;
- e. The time and duration of the release;
- f. The medium receiving the release (air, land, water);
- g. Known acute or chronic health risks;
- h. Medical advice when necessary; and
- i. Recommended community precautions.

3.12.3.2 Follow-Up Notice

Within 5 days of the release, a written follow-up notice of the release shall be provided to the FEC and the Contracting Officer. The written notice shall update information provided in the initial report, provide detailed information on the response actions taken, and provide advice regarding medical attention necessary for exposed individuals.

3.12.3.3 State EPCRA Agency

The Contractor may call the following agency for information about EPCRA requirements:

New Mexico Department of Public Safety
New Mexico Emergency Response Commission
P.O. Box 1628
Santa Fe, New Mexico 87504-1628
Telephone Number 505-827-9923

ATTACHMENT A
BASIC STORMWATER POLLUTION PREVENTION PLAN
FOR
AMMUNITION SUPPLY POINT
MCGREGOR RANGE, FORT BLISS, TEXAS
CONTRACT NO. DACA63-97-D-0030

1.0 SUMMARY

1.1 PROJECT SUMMARY. Fort Bliss is currently an active U.S. Army base whose mission focus is on Air Defense Artillery. As the center for air defense, Fort Bliss is home to the U.S. Army Air Defense Artillery School and four ADA brigades. Fort Bliss is a premier facility for training, mobilization, and deploying combat forces. In 1893, Fort Bliss relocated to its sixth and present location on La Noria Mesa overlooking El Paso, Texas and Juarez, Mexico and covers approximately 1.1 million acres.

The objective of this project is to relocate the Ammunitions Supply Point (ASP) from the Fort Bliss Main Post Area to the McGregor Range. The McGregor Range is located in south-central Otero County, New Mexico and was established in 1957 when the U.S. Army acquired 71,000 acres of private land and was granted a 20-year withdrawal of 608,000 acres of public land. The McGregor Range ASP, where construction activities will be conducted, is located 5.2 miles west of the McGregor Range Camp in the Tularosa Valley and covers approximately 60 acres. It is estimated that the project construction activities will disturb approximately 32 acres stretched over an area encompassing approximately 60 acres.

Construction activities associated with the project include: eight standard design ammunition magazines (earth covered) with two additional magazines as a construction option; a surveillance workshop; an inert storage facility; a loading dock and pad; a guardhouse; a Salvage Yard office building; an addition to the existing Operations Building; aboveground petroleum, oils, and lubricants (POL) dispensing facility; an extension of security fencing to include utilities; electric service; security lighting; paving; walks; curbs, gutters, and extension of paved roads; a Safe Haven parking lot; storm drainage; information systems; and site improvements.

1.2 STANDARD INDUSTRIAL CLASSIFICATION (SIC) CODES.

The construction activities associated with this project have the following SIC codes:

- A. 1541 General Contractors – Industrial Buildings and Warehouses
- B. 1629 Heavy Construction, Except Dredging, N.E.C.
- C. 1796 Installation or Erection of Building Equipment, N.E.C.

1.3 LOCATION. McGregor Range is located in south-central Otero County, New Mexico covering approximately 679,000 acres. The 60 acre McGregor Range ASP project location is approximately 20 miles northeast of El Paso, 5.2 miles west of the McGregor Range Camp, and one mile south of the main access road leading to U.S. Highway 54. The approximate latitude and longitude of the project center is latitude 32°3'30" and longitude 106°15'15".

The McGregor Range ASP project location is approximately 7 miles west-southwest of the McGregor Missile Range Camp and the Davis Dome. Development northwest of the project

location includes the Southern Pacific Railroad, U.S. Highway 54, and the Fort Bliss Military Reservation.

1.4 RECEIVING WATERS. The principle drainage in the region is the Rio Grande River, a northwest-northeast flowing river, located approximately 30 miles west of the construction location. All drainage in this region is intermittent with flow occurring only during and after heavy rainfall events. Storm water drainage in the project area generally flows to the south; however, due to the nature of precipitation (i.e. approximately 4-5 inches/year) and the flat grade in the Tularosa Valley region, surface drainage primarily either evaporates into the air or percolates into the ground. For rains when surface drainage may occur, runoff is routed to existing drainage ditches and eventually dissipates to the surrounding flat surface soils where percolation and evaporation of the surface drainage results.

2.0 SITE DESCRIPTION

2.1 EXISTING CONDITIONS. The existing Ammunition Supply Point (ASP) is situated in a remote, very flat, desert-like area in McGregor Range. Existing development at the project site includes the Operations Building, the Sentry Building, an 8-foot chain link security fencing, the Guardhouse, various wood and metal buildings, and a shed. The approximate grading in the area ranges from 0.5% to 8% +/- and gently slopes towards the south. The pre-construction runoff coefficient (C) (i.e. 0.5) is a book value determined from existing soil conditions. A ten (10) year design storm event was used for all runoff calculations.

2.2 FUTURE CONDITIONS. The purpose of this project is to complete plans and specifications for the relocation of the Ammunition Supply point (ASP) from the Fort Bliss Main Post Area to the McGregor Range. Throughout and after the construction process, storm water management measures will be taken to reduce pollutants in storm water discharge from the site. Proposed drainage patterns will typically follow those used previously within the existing ASP. New grading will not effect the storm water flow paths with the exception of the Ammunition Magazine earthen cover, which will have 2:1 side slopes. To account for the new grading, four permanent culverts will be used to control storm water flow. From there, the storm water will drain onto the newly constructed roads around the Ammunition Magazines and dissipate as sheet flow onto the ground surface where percolation and evaporation will result. The future runoff coefficient was calculated to be 0.16 to 0.33 in the different sub-areas using the intensity of a 3.6 inch/hour storm. The total estimated runoff volume for the project is estimated to be approximately twenty (20) to twenty-five (25) cfs.

2.3 CONSTRUCTION PHASING. Construction is scheduled to begin during first quarter of Fiscal Year 1999 (1st Q FY'99), and last for approximately 365 days. The major elements of construction include the following:

A. Grading - The site shall be graded for positive removal of storm water before and during building and pavement construction. Grading at the site will be minimal with the exception of the Ammunition Magazine earthen cover, which will have 2:1 side slopes. The remainder of the grading will involve slopes ranging from 0.5% to 8% +/-.

B. Pavements - The circumferential roadway outside of the new fence will consist of a compacted gravel roadway. The Safe Haven parking area within the fenced area of the ASP

will be paved with bituminous paving. The additional roadways constructed around the new Ammunition Magazines will match the existing asphalt roadway.

C. **Storm Drainage** – The proposed drainage patterns will typically follow those used previously within the existing ASP. Paved areas will be graded to allow runoff to dissipate as sheet flow onto the surrounding flat ground surface. The outlet pipe to the oil/water separator directs storm water runoff to a drainage ditch that eventually leads runoff to dissipate onto the ground surface where percolation and evaporation result.

D. **Utilities** – An existing 6-inch water main runs alongside the ASP entrance road. This line feeds the Operations Building through a 2-inch line and the existing surveillance Workshop through a 4-inch PVC line. The 6-inch line will be extended to service the relocated Surveillance Workshop. The new Surveillance Workshop will require a septic system and leach field.

E. **Fencing** – The existing 8-foot high chain link security fencing will be extended around the perimeter of the expanded ASP facility. Two new gates will be provided. One gate will be provided at the new entrance location. Another gate will be provided from the salvage yard to the ASP. Temporary fencing may be installed to allow construction of the magazines to occur without compromising the security of the existing facility. The temporary fencing would isolate the existing Ammunition Magazines from the construction areas and allow a separate contractor entrance.

F. **Turfing and Landscaping** – No landscaping of turfing will be provided within the project area.

2.4 SOILS DATA. The following soils information is from a geotechnical study of the proposed infrastructure improvements to the ASP, McGregor Range, conducted by Danny R. Anderson Consultants, Inc., written June 2, 1998.

This site contains soil corresponding to the Pintura-Dona Ana Complex, 0 to 5 percent slopes according to the Soil Conservation Service, Otero County Soil Survey. The site consists of large areas of deep, well drained and somewhat excessively drained soils. The area is nearly level to undulating, medium textured and coarse textured dunes and the areas between the dunes. The Pintura soil is on the partly stabilized coppice dunes, and the Dona Ana soil is between the dunes.

Typically, the Pintura surface layer is light, reddish-brown, loamy, fine sand about 12 inches thick. The substratum is a light, reddish-brown, fine sand to a depth of more than 60 inches. This soil is slightly calcareous and mildly alkaline throughout. Permeability is rapid, and available water capacity is low.

The Dona Ana surface layer is a reddish-brown, fine, sandy loam about 3 inches thick. The subsoil is a reddish-brown, sandy, clay loam about 18 inches thick. The substratum is a pinkish-gray, sandy, clay loam and light, reddish-brown, sandy loam to a depth of more than 60 inches. The soil is strongly calcareous and moderately alkaline throughout. Permeability is moderate, and available water capacity is high.

2.5 DRAWINGS. See drawing (i.e., Plans for Ammo Supply Point Improvements, Phase II) Layout Plans Sheet Nos. C6 of 25 through C11 of 25. These Layout Plans for the entire construction area provide 1) locations and details of all stormwater control features, 2) direction of drainage, 3) flow line of ditches and 4) approximate grading limits. Additionally,

erosion control in the form of silt fence is also shown for those areas where it would be most effective.

3.0 EROSION AND SEDIMENT CONTROL

3.1 TEMPORARY/PERMANENT STABILIZATION. Disturbed areas shall be graded to control erosion. The area of bare soil exposed at any one time by construction operations shall be held to a minimum. Unless otherwise approved by the Contracting Officer, the Contractor shall stabilize the denuded ground on any particular portion of the site within 14 days after construction activity has temporarily or permanently ceased, except for areas where construction activities will resume within 21 days from when construction activities ceased.

Temporary and permanent stabilization may be achieved with mulching, geotextile, vegetative buffer strips, or a combination of these methods. When construction activities have ceased the Contractor shall provide stabilization for all unpaved, graded, and disturbed portions of the site. The soil shall be tilled to a depth of four (4) inches, native prairie hay spread at a rate of 4000 pounds per acre, and mulch anchored into place using a mulch anchoring machine or equivalent to a disk harrow with cupped disks removed and replaced with straight rolling coulters spaced not more than eight (8) inches apart.

3.2 TEMPORARY SEDIMENT BASINS. Due to the nature of precipitation (i.e. approximately 4-5 inches/year) and the flat grade in the Tularosa Valley region, a temporary sediment basin would be impractical at this site.

3.3 STRUCTURAL CONTROLS. The Contractor shall use silt fences, temporary earth dikes, stacked hay bales, rock dams, check dams, or other approved structural controls necessary to prevent soil erosion at the construction site. In general, controls shall be used at any location where construction at the project reduces the potential for significant erosion damage (i.e. unpaved, disturbed land).

4.0 STORM WATER MANAGEMENT CONTROLS.

4.1 RUNOFF COEFFICIENTS. After construction, the runoff coefficient (C) was calculated to be approximately 0.16 to 0.33 for the different sub-areas of the site. The runoff coefficient was determined using a storm intensity of 3.6 inches/hour. The existing natural storm drainage is adequate and shall be used to accept storm water flows from the site.

4.2 STORM DRAINAGE SYSTEM. There is no existing storm drainage pipe system on the site. The proposed drainage patterns will typically follow those used previously within the existing ASP. Paved areas will be graded to allow runoff to dissipate as sheet flow onto the surrounding flat ground surface. The outlet pipe to the oil/water separator and culverts with concrete headwalls in the Ammunition Magazine area direct storm water runoff to a drainage ditch that eventually leads runoff to dissipate onto the ground surface where percolation and evaporation result.

4.3 OUTFALL VELOCITY DISSIPATION DEVICES. Rock or concrete lined outfalls will be installed to dissipate storm water energy from outfalls greater than 3% slopes to minimize erosion of natural soils at the site.

5.0 BEST MANAGEMENT PRACTICES DURING CONSTRUCTION

5.1 WASTE MATERIALS. Solid waste, i.e. trash and garbage, shall be placed in appropriate waste containers and covered. Waste containers shall be emptied regularly; they shall not be allowed to overflow. No construction waste materials shall be buried or otherwise disposed on site. All site personnel shall be briefed on the correct procedures for solid waste disposal.

5.2 HAZARDOUS WASTE. All hazardous waste shall be handled, stored, and disposed in accordance with all Federal, State, and local regulations. Chemical waste shall be stored in clearly labeled, corrosion-resistant containers, and stored in designated areas before removal from the site. All site personnel shall be briefed on the correct procedures for hazardous waste disposal.

5.3 SANITARY WASTE. On-site sanitary facilities shall be established by the Contractor. Facility location, design, maintenance, and waste collection practices shall be in accordance to local regulations.

5.4 OFF-SITE VEHICLE TRACKING. Every effort shall be made to keep vehicles from tracking soils from the construction site. Materials hauled from the construction site in open-bed vehicles shall be covered or otherwise stabilized to avoid their loss during transport.

5.5 FERTILIZERS. It is not anticipated that any fertilizers will be necessary.

5.6 CONTAMINATED SOILS "There will not be any requirement to dispose of hazardous or contaminated materials", per DD Form 1391, Section 15, Environmental Analysis.

5.7 CONSTRUCTION VEHICLE MAINTENANCE AND REPAIR. Specific areas shall be designated for equipment maintenance and repair. Locations of these areas shall be chosen to minimize potential impacts on receiving waters. All construction vehicles shall be regularly inspected for leaks and receive regularly scheduled maintenance to reduce the potential for leaks.

5.8 VEHICLE FUELING. Vehicle fueling at the project site shall be conducted in accordance with good safety practices to reduce the potential for leaks and spills. Only properly constructed fuel containers shall be used on site and shall be labeled and stored in accordance with applicable codes. Washing and curing waters shall be drained into a retention basin constructed by the Contractor, and to be cleaned up by the Contractor, to the satisfaction of the Contracting Officer, after project completion.

6.0 TIMING CONTROLS AND ACTIVITIES.

Perimeter controls discussed in Section 3.4 should be placed before any work at the site commences. Temporary and permanent stabilization measures shall be implemented as described in Section 3.0. When construction temporarily ceases, erosion control shall be established in accordance

with Section 3.1. When construction permanently ceases, permanent stabilization shall be implemented in accordance with Section 3.2.

7.0 COMPLIANCE WITH FEDERAL, STATE, AND LOCAL REGULATIONS.

Army Regulation 200-1 requires that all Department of Defense installations and their contractors observe federal environmental protection statutes, which include a provision to observe local environmental regulations. In addition to any State of New Mexico and Otero County environmental laws, the Contractor shall observe Environmental Protection Agency (EPA) regulations.

These regulations require that the Contractor develop a detailed Storm Water Pollution Prevention Plan which conforms with the requirements of "Final NPDES General Permits for Storm Water Discharge from Construction Sites" published in the Federal Register, Volume 57, Number 175, dated 9 September 1992. The 1992 NPDES Region 6 construction general permit for Texas, New Mexico, Oklahoma, and Louisiana expired 9 September 1997. A new construction general permit will replace the 1992 version. The new EPA Region 6 NPDES Storm Water Construction general permit is scheduled to be issued by 25 June 1998, and will be very similar to the National permit. Additional information regarding this subject can be found on the following Internet address:

<http://www.epa.gov/earth/r6/gen/w/sw/hottpcn.htm>.

The Contractor shall include in the plan a detailed list of the Best Management Practices which it has developed and shall describe in the plan how the practices shall be implemented.

The proposed construction project is in compliance with the National Environmental Policy Act (NEPA) of 1969. A Record of Environmental Consideration (REC) was conducted for the proposed project dated June 1998. The proposed project is categorically excluded (CE) according to the terms stated in CE A-7 in AR 200-2-2. The proposed project will not adversely impact any Federal or state listed threatened or endangered species or cultural resources.

8.0 MAINTENANCE AND INSPECTION PROCEDURES.

The Contractor's quality control organization shall inspect all pollution prevention measures at least once every 7 days and within twenty four hours following any storm producing 13 mm of water. The inspector shall thoroughly understand the requirements of the Contractor's detailed Pollution Prevention Plan (PPP) and shall have a basic knowledge of the engineering principles for reducing runoff pollution.

Temporary grading shall be inspected for erosion and soil loss from the site. Temporary erosion control measures shall be inspected for bare spots and washouts. Discharge points shall be inspected for signs of erosion of sediment associated with the discharge. Locations where vehicles enter and leave the site shall be checked for signs of off-site sediment tracking. Best Management Practices and control maintenance procedures shall be reviewed for adequacy.

Any deficiencies shall be noted in the inspection reports and corrections implemented within seven calendar days. The PPP shall be revised as necessary. After final stabilization has been achieved, the Contractor shall inspect the site once a month until final inspection and project acceptance by the Corps.

9.0 MATERIAL INVENTORY

The following materials or substances may be present on-site during construction: concrete, paints, sealants, petroleum-based products, cleaning solvents, fertilizers, tar, asphalt, and steel reinforcing bars.

10.0 NON-STORM WATER DISCHARGES

Non-storm water discharges shall not be allowed during construction of the project except for emergency fire-fighting flows and other flows permitted in Federal Register Volume 57 Number 175, dated 9 September 1992, referenced in paragraph 7.0. In addition, any spill of a hazardous substance of oil in excess of reporting quantities shall be reported as required under Code of Federal Regulations; 40 CFR 110, 40 CFR 302, and 40 CFR 355 and any other applicable regulations.

11.0 CONTRACTOR COMPLIANCE

After this project has been awarded, the Contractor shall develop a detailed PPP within the guidelines of the basic PPP. As the party in control of the daily operations at the construction site, the Contractor shall submit a separate "Notice of Intent for Storm Water Discharges Associated with Industrial Activity" under the National Pollution Discharge Elimination System (NPDES) General Permit.

ATTACHMENT B
STORM WATER POLLUTION PREVENTION PLAN
INSPECTION AND MAINTENANCE REPORT

INSPECTOR: _____ DATE: _____

INSPECTOR'S QUALIFICATIONS:

DAYS SINCE LAST RAINFALL: _____ AMOUNT OF LAST RAINFALL: _____ INCHES

STABILIZATION MEASURES

AREA	DATE SINCE	DATE OF	STABILIZED?	STABILIZED	CONDITION
	LAST	NEXT	(YES/NO)	WITH?	
	DISTURBANCE	DISTURBANCE			

STABILIZATION REQUIRED:

TO BE PERFORMED BY: _____ ON OR BEFORE: _____
"

STORM WATER POLLUTION PREVENTION PLAN

INSPECTION AND MAINTENANCE REPORT

STRUCTURAL CONTROLS - EARTH DIKE(S)

FROM	TO	IS DIKE STABILIZED? OF WASH-OUT OR OVERTOPPING?	IS THERE EVIDENCE
------	----	---	-------------------

MAINTENANCE REQUIRED FOR THE EARTH DIKE(S):

TO BE PERFORMED BY: _____ ON OR BEFORE: _____

STRUCTURAL CONTROLS - SEDIMENT BASIN(S)

DEPTH OF SEDIMENT IN BASIN	CONDITION OF BASIN SIDE SLOPES	ANY EVIDENCE OF OVERTOPPING OF THE EMBANKMENT?	CONDITION OF OUTFALL FROM THE SEDIMENT BASIN?
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“

STORM WATER POLLUTION PREVENTION PLAN

INSPECTION AND MAINTENANCE REPORT

MAINTENANCE REQUIRED FOR SEDIMENT BASIN(S):

TO BE PERFORMED BY: _____ ON OR BEFORE: _____

STRUCTURAL CONTROLS - SILT FENCE(S)

FROM	TO	IS THE BOTTOM OF THE FABRIC STILL BURIED?	IS THE FABRIC IN GOOD CONDITION?	HOW DEEP IS THE SEDIMENT?
<hr/>				

MAINTENANCE REQUIRED FOR THE SILT FENCE(S):

TO BE PERFORMED BY: _____ ON OR BEFORE: _____

“

STORM WATER POLLUTION PREVENTION PLAN

INSPECTION AND MAINTENANCE REPORT

OTHER CONTROLS - STABILIZED CONSTRUCTION ENTRANCE

IS MUCH SEDIMENT TRACKED ONTO THE ROAD?	ARE DUST AND SEDIMENT CONTROL MEASURES WORKING?	DOES ALL TRAFFIC USE THE STABILIZED ENTRANCE TO THE WORKING?	ARE ASSOCIATED DRAINAGE STRUCTURES
---	--	---	--

MAINTENANCE REQUIRED FOR CONSTRUCTION ENTRANCE:

TO BE PERFORMED BY: _____ ON OR BEFORE: _____

OTHER CONTROLS - DEVELOP SITE SPECIFIC TABLES AS NEEDED

FOR ALL STABILIZATION MEASURES, STRUCTURAL AND NON-STRUCTURAL CONTROLS

CHANGES REQUIRED TO THE POLLUTION PREVENTION PLAN:

“

STORM WATER POLLUTION PREVENTION PLAN
INSPECTION AND MAINTENANCE REPORT

REASONS FOR CHANGES:

INSPECTOR'S SIGNATURE: _____ DATE: _____

SECTION 02221

EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS 07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2216	(1992) Laboratory Determination of Water (Moisture) Content of Soil, and Rock
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2937	(1994) Density of Soil in Place by the Drive-Cylinder Method
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 DEFINITIONS

1.2.1 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated hereinafter as percent laboratory maximum density.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Field Density Tests; GA. Testing of Backfill Materials; GA.

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

PART 2 PRODUCT

2.1 MATERIALS

2.1.1 Satisfactory Materials

Satisfactory materials include materials classified in ASTM D 2487 as GW, GP, SW, GC, GM, SP, SC and SM and shall be free of trash, debris, roots or other organic matter, or stones larger than (3/4 inches) in any dimension.

2.1.2 Unsatisfactory Materials

Unsatisfactory materials include materials classified in ASTM D 2487 as Pt, OH, OL, ML, MH, CL and CH and any other materials not defined as satisfactory.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.

2.1.4 Sand Filter Material

Sand Filter material shall be in accordance with ASTM C33 "Concrete Fine Aggregate" and shall have the following grading requirements:

Sieve	%Retained
3/8	0%
NO 4	0 TO 5%
NO 8	0 TO 20%
NO 16	15 TO 50%
NO 30	35 TO 75%
NO 50	65 TO 90%
NO 100	90 TO 100%
NO 200	97 TO 100%

2.1.5 Impervious Fill

Impervious fill shall have a liquid limit between 40 and 50 and a plasticity index greater than 15.

2.2 Capillary Water Barrier and Gravel Filter Material

Capillary Water Barrier shall consist of clean, crushed, nonporous rock,

crushed gravel, or uncrushed gravel. The maximum particle size shall be 1-1/2 inches and no more than 2 percent by weight shall pass the No.4 size sieve.

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

The areas within lines outside of each building and structure line shall be cleared and grubbed of trees, stumps, roots, brush and other vegetation, debris, existing foundations, pavements, utility lines, structures, fences, and other items that would interfere with construction operations. Stumps, logs, roots, and other organic matter shall be completely removed and the resulting depressions shall be filled with satisfactory material, placed and compacted in accordance with paragraph FILLING AND BACKFILLING. Materials removed shall be disposed of in the designated waste disposal areas .

3.2 TOPSOIL

Topsoil shall be stripped to a depth of below existing grade within the designated excavations and grading lines and deposited in storage piles for later use. Excess topsoil shall be disposed as specified for excess excavated material.

3.3 EXCAVATION

Excavation shall conform to the dimensions and elevations indicated for each building, structure, and footing except as specified hereinafter, and shall include trenching for utility and foundation drainage systems to a point beyond the building line of each building and structure, excavation for outside grease interceptors, and all work incidental thereto. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed and replaced with satisfactory material. Payment therefor will be made in conformance with the CHANGES clause of the CONTRACT CLAUSES. Satisfactory material removed below the depths indicated without specific direction of the Contracting Officer shall be replaced at no additional cost to the Government to the indicated excavation grade with satisfactory materials, except that concrete footings shall be increased in thickness to the bottom of the overdepth excavations . Satisfactory material shall be placed and compacted as specified in paragraph FILLING AND BACKFILLING. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

3.4 DRAINAGE AND DEWATERING

3.4.1 Drainage

Surface water shall be directed away from excavation and construction sites so as to prevent erosion and undermining of foundations. Diversion ditches, dikes and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed

so that the site and the area immediately surrounding the site and affecting operations at the site shall be continually and effectively drained.

3.4.2 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material.

3.5 CLASSIFICATION OF EXCAVATION

Excavation will be unclassified regardless of the nature of material encountered.

3.6 UTILITY AND DRAIN TRENCHES

Trenches for underground utilities systems and drain lines shall be excavated to the required alignments and depths. The bottoms of trenches shall be graded to secure the required slope and shall be tamped if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length.

3.7 BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials shall be obtained . From an on site borrow area, as designed on the drawings or by the contracting officer.

3.8 EXCAVATED MATERIALS

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required under this section or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of in an area off site as designated on the drawings or by the contracting officer.

3.9 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Excavation to final grade shall not be made until just before concrete is to be placed. Excavation bottoms shall be protected from slaking or other erosion resulting from ponding or flow of water.

3.10 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials. As a minimum, remove and dispose of 1'-0" of existing subgrade under all buildings. The surface shall be scarified to a depth of before the fill is started.

Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. General fill material shall be moistened or aerated as necessary to plus or minus 2 percent of optimum moisture. Impervious fill material shall be compacted at a moisture content between 2 and 4% of optimum moisture. Minimum subgrade density shall be as specified in paragraph FILLING AND BACKFILLING.

3.11 FILLING AND BACKFILLING

Satisfactory materials shall be used in bringing fills and backfills to the lines and grades indicated and for replacing unsatisfactory materials. Satisfactory materials shall be placed in horizontal layers not exceeding in loose thickness, or when hand-operated compactors are used. After placing, each layer shall be plowed, disked, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed and compacted as specified. Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade and shall include backfill for outside grease interceptors. Backfill shall not be placed in wet areas. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation (2 feet) above sewer lines and (1 foot) above other utility lines shall be free from stones larger than (1 inch) in any dimension. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation, retaining walls, and arch roofs than a distance equal to the height of backfill above the top of footing or roof; the area remaining shall be compacted in layers not more than (4 inches) in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall. Each layer of fill and backfill shall be compacted to not less than the percentage of maximum density specified below:

Fill, embankment, and backfill

Under structures, building slabs, steps, paved areas, around footings, and in trenches	90	92
Under sidewalks and grassed areas	85	90
Over Magazine roof		
	95	

Subgrade

Under building slabs, steps, and paved areas, top 12 inches	90	95
Under sidewalks, top 6 inches	85	90

Approved compacted subgrades that are disturbed by the Contractor's operations or adverse weather shall be scarified and compacted as specified herein before to the required density prior to further construction thereon. Recomaction over underground utilities and heating lines shall be by hand tamping.

3.12 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or may be performed by the Contractor subject to approval. Field in-place density shall be determined in accordance with ASTM D 1556, or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted if necessary by the procedure described in ASTM D 2922, paragraph ADJUSTING CALIBRATION CURVE. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. ASTM D 2937 shall be used only for soft, fine-grained, cohesive soils. The following number of tests, if performed at the appropriate time, shall be the minimum acceptable for each type operation.

3.12.1 In-Place Densities

3.12.1.1 In-Place Density of Subgrades

One test per 5000 square or fraction thereof.

3.12.1.2 In-Place Density of Fills and Backfills

One test per 1000 square feet or fraction thereof of each lift for fill or backfill areas compacted by other than hand or hand-operated machines. The density for each lift of fill or backfill materials for trenches, pits, building perimeters, retaining walls over magazine roof, or other structures or areas less than 5 feet in width, which are compacted with hand or hand-operated machines shall be tested as follows: One test per lift per each area less than 2000 square feet, or one test for each 100 linear feet of long narrow fills 100 feet or more in length. If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 as follows: One check per lift for each 200 linear feet of long narrow fills, and a minimum of 1 checks per lift for other fill and backfill areas

3.12.2 Moisture Content

In the stockpile, excavation or borrow areas, a minimum of two tests per

day per type of material or source of materials being placed is required during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D 2216.

3.12.3 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values according to ASTM 1557. One representative test per (50 cubic yards) of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density will be made.

3.13 CAPILLARY WATER BARRIER

Capillary water barrier under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.14 GRADING

Areas within (5 feet) outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has been accepted. Fill around buildings shall be graded to an elevation of 1'-0" below finish floor at building line and slope at 2% to existing grade unless shown otherwise.

3.15 SPREADING TOPSOIL

Areas outside the building lines from which topsoil has been removed shall be topsoiled. The surface shall be free of materials that would hinder planting or maintenance operations. The subgrade shall be pulverized to a depth of (2 inches) by disking or plowing for the bonding of topsoil with the subsoil. Topsoil shall then be uniformly spread, graded, and compacted to the thickness, elevations, slopes shown, and left free of surface irregularities. Topsoil shall be compacted by one pass of a cultipacker, roller, or other approved equipment weighing (100 to 160 pounds per linear foot) of roller. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to seeding, planting, or proper grading.

3.16 PROTECTION

Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work shall be repaired and grades reestablished to the required elevations and slopes.

-- End of Section --

SECTION 02222

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS 07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422	(1963; R 1990) Particle-Size Analysis of Soils
ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.2 Trench Excavation

Excavation is unclassified and payment for same will be on accordance with the schedule of values of the contractors lumpsum bid.

1.3 Select Granular Material

Select granular material shall be measured in place as the actual cubic yards replacing wet or unstable material in trench bottoms within either the limits shown or in unauthorized overdepth areas. The price shall include furnishing and placing the granular material, excavation and disposal of unsatisfactory material, and additional requirements for sheeting and bracing, pumping, bailing, cleaning, and other incidentals necessary to complete the work. Payment for select granular material shall be made in addition to the Lumpsum for trench excavation.

1.4 DEFINITIONS

1.3.1 Degree of Compaction

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557

1.5 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 SD Reports

Field Density Tests;FIO ; 02222

Testing of Backfill Materials;FIO; 02222

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

PART 2 PRODUCT

2.1 MATERIALS

2.1.1 Satisfactory Materials

Satisfactory materials shall consist of any material classified by ASTM D 2487 as GM,GC,SP,SC,SM,GW,GP and SW.

2.1.2 Unsatisfactory Materials

Unsatisfactory materials shall be materials that do not comply with the requirements for satisfactory materials. Unsatisfactory materials include but are not limited to those materials containing roots and other organic matter, trash, debris, frozen materials and stones larger than 76 millimeters, (3inches,) and materials classified in ASTM D 2487, as ML,MH,CL, CH, PT, OH, and OL or where plasticity index exceed 20 Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials shall include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.

2.1.4 Unyielding Material

Unyielding material shall consist of rock and gravelly soils with stones greater than 76 millimeters (3inches) in any dimension or as defined by the pipe manufacturer, whichever is smaller.

2.1.5 Unstable Material

Unstable material shall consist of materials too wet to properly support

the utility pipe, conduit, or appurtenant structure.

2.1.6 Select Granular Material

Select granular material shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall contain not more than 10 percent by weight of material passing a 0.075 mm (No. 200) mesh sieve and no less than 95 percent by weight passing the 25 mm (1 inch) sieve. The maximum allowable aggregate size shall be 76 millimeters (3 inches), or the maximum size recommended by the pipe manufacturer, whichever is smaller.

2.1.7 Initial Backfill Material

Initial backfill shall consist of select granular material or satisfactory materials free from rocks 76 millimeters (3 inches) or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, the initial backfill material shall be free of stones larger than 76 millimeters (3 inches) in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

2.1.8 Plastic Marking Tape

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 152 mm (6 inches) wide with minimum thickness of 0.102 mm (0.004 inch). Tape shall have a minimum strength of 12.1 MPa (1750 psi) lengthwise and 10.3 MPa (1500 psi) crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 1 meter (3 feet) deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in TABLE 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1. Tape Color

Red:	Electric
Yellow:	Gas, Oil, Dangerous Materials
Orange:	Telephone, Telegraph, Television, Police, and Fire Communications
Blue:	Water Systems
Green:	Sewer Systems

PART 3 EXECUTION

3.1 EXCAVATION

Excavation shall be performed to the lines and grades indicated. Rock excavation shall include removal and disposition of material defined as rock in paragraph MATERIALS. Earth excavation shall include removal and disposal of material not classified as rock excavation. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation, but in no instance closer than 600 mm. (2 feet.)

Excavated material not required or not satisfactory for backfill shall be disposed of by the contractor to the designated site approved by the

contracting officer. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed to maintain the stability of the bottom and sides of the excavation. Unauthorized overexcavation shall be backfilled in accordance with paragraph BACKFILLING AND COMPACTION at no additional cost to the Government.

3.1.1.1 Trench Excavation

The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls shall be made vertical. Trench walls more than .305 meters (3 feet) high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in. Vertical trench walls more than 1.829 meters (6 feet) high shall be shored. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 600 mm (24 inches) plus pipe outside diameter (O.D.) for pipes of less than 600 mm (24inches) inside diameter and shall not exceed 900 mm (36inches) plus pipe outside diameter for sizes larger than 600 mm (24inches) inside diameter. Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Government.

3.1.1.1.1 Bottom Preparation

The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 76 millimeters (3inches) or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

3.1.1.1.2 Removal of Unyielding Material

Where overdepth is not indicated and unyielding material is encountered in the bottom of the trench, such material shall be removed 450 millimeters (18inches) below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION

3.1.1.1.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the fault or neglect of the Contractor in his performance of the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Government.

3.1.1.1.4 Excavation for Appurtenances

Excavation for manholes, catch-basins, inlets, or similar structures shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock shall be cleaned of loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Loose disintegrated rock and thin strata shall be removed. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.1.1.5 Jacking, Boring, and Tunneling

Unless otherwise indicated, excavation shall be by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

3.1.1.6 Stockpiles

Stockpiles of satisfactory, unsatisfactory and wasted materials shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Government.

33.2 BACKFILLING AND COMPACTION

Backfill material shall consist of satisfactory material, select granular material, or initial backfill material as required. Backfill shall be placed in layers not exceeding 150 mm (6 inches) loose thickness for compaction by hand operated machine compactors, and 200 mm (8 inches) loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent maximum density for cohesionless soils and 90 percent maximum density for cohesive soils, unless otherwise specified.

3.2.1 Trench Backfill

Trenches shall be backfilled to the grade shown. The trench shall be backfilled to 610 mm (2 feet) above the top of pipe prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure test. The trench shall not be backfilled until all specified tests are performed.

3.2.1.1 Replacement of Unyielding Material

Unyielding material removed from the bottom of the trench shall be replaced with select granular material or initial backfill material.

3.2.1.2 Replacement of Unstable Material

Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.

3.2.1.3 Bedding and Initial Backfill

Bedding shall be of the type and thickness shown. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

3.2.1.4 Final Backfill

The remainder of the trench, except for special materials for roadways, railroads and airfields, shall be filled with satisfactory material. Backfill material shall be placed and compacted as follows:

a. Roadways, Railroads, and Airfields: Backfill shall be placed up to the elevation at which the requirements in Section 02225 EARTHWORK FOR ROADWAYS, RAILROADS, AND AIRFIELDS control. Water flooding or jetting methods of compaction will not be permitted.

b. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas: Backfill shall be deposited in layers of a maximum of 300 mm (12 inch) loose thickness, and compacted to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Compaction by water flooding or jetting will not be permitted. This requirement shall also apply to all other areas not specifically designated above.

3.2.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for 3 days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.3 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.3.1 Gas Distribution

Trenches shall be excavated to a depth that will provide not less than 450 mm (18 inches) of cover in rock excavation and not less than 600 mm (24 inches) of cover in other excavation. Trenches shall be graded as specified for pipe-laying requirements.

3.3.2 Water Lines

Trenches shall be of a depth to provide a minimum cover of 610 meters (2 feet) from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. [For fire protection yard mains or piping, an additional cover shall be provided in accordance with the applicable requirements of NFPA.

3.3.3 Heat Distribution System

Initial backfill material shall be free of stones larger than 6.3 mm (1/4 inch) in any dimension.

3.3.4 Electrical Distribution System

Direct burial cable and conduit or duct line shall have a minimum cover of 600 mm (24 inches) from the finished grade, unless otherwise indicated. Special trenching requirements for direct-burial electrical cables and conduits are specified in Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

3.3.5 Plastic Marking Tape

Warning tapes shall be installed directly above the pipe, at a depth of 450 millimeters (18 inches) below finished grade unless otherwise shown.

3.4 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government.

3.4.1 Testing Facilities

Tests shall be performed by an approved commercial testing laboratory or may be tested by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved by the Contracting Officer. The first inspection shall be at the expense of the Government. Cost incurred for any subsequent inspection required because of failure of the first inspection will be charged to the Contractor.

3.4.2 Testing of Backfill Materials

Characteristics of backfill materials shall be determined in accordance with particle size analysis of soils ASTM D 422 and moisture-density relations of soils ASTM D 1557. A minimum of one particle size analysis and one moisture-density relation test shall be performed on each different type of material used for bedding and backfill.

3.4.3 Field Density Tests

Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained. A minimum of one field density test per lift of backfill for every 91.44 meters (300feet) of installation shall be performed. One moisture density relationship shall be determined for every 1500 cubic meters (1500 cubic yards) of material used. Field in-place density shall be determined in accordance with ASTM D 1556 ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be

checked and adjusted using the sand cone method as described in paragraph Calibration of the ASTM publication. ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job, on each different type of material encountered, at intervals as directed by the Contracting Officer. Copies of calibration curves, results of calibration tests, and field and laboratory density tests shall be furnished to the Contracting Officer. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Government.

3.4.4 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to the finished grade surface, the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Contracting Officer. Pipe sizes larger than 900 mm (36 inches) shall be entered and examined, while smaller diameter pipe shall be inspected by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgement of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to the Government

-- End of Section --
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SECTION 02225

EARTHWORK FOR ROADWAYS, RAILROADS, AND AIRFIELDS
07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136	(1995a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	(1963; R 1990) Particle-Size Analysis of Soils
ASTM D 1140	(1992) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2937	(1994) Density of Soil in Place by the Drive-Cylinder Method
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 DEFINITIONS

1.2.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by, ASTM D 2487 as GW, GP, SW, GM, GC, SP, SC, SM. Satisfactory materials for grading shall be free from roots and other organic matter, trash, debris, and frozen materials and stones larger than 75mm(3 inches) in any dimension.

1.2.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Materials classified in ASTM D 2487 as ML, MH, CL, CH, Pt, OH, and OL are unsatisfactory. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

1.2.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Testing required for classifying materials shall be in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

1.2.4 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as a percent of laboratory maximum density.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Statements

Earthwork; FIO.

Procedure and location for disposal of unused satisfactory material.
Proposed source of borrow material.

SD-09 Reports

Testing; GA.

Within 24 hours of conclusion of physical tests, 3 copies of test results, including calibration curves and results of calibration tests.

SD-13 Certificates

Testing; FIO.

Qualifications of the commercial testing laboratory or Contractor's testing facilities.

SD-18 Records

Earthwork; FIO.

Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

1.4 SUBSURFACE DATA

Subsurface soil boring logs are shown on the drawings . The subsoil investigation report and samples of materials taken from subsurface investigations may be examined at the office of Danny R. Anderson Consultants Inc. Geotechnical & Environmental Engineers, 4601 Ripley, El Paso, TX, 79922, (915)584-1317. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.5 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.6 UTILIZATION OF EXCAVATED MATERIALS

Unsatisfactory materials removed from excavations shall be disposed of in designated waste disposal or spoil areas. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in designated areas approved for surplus material storage or designated waste areas as directed. Newly designated waste areas on Government-controlled land shall be cleared and grubbed before disposal of waste material thereon. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory

materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. Such excavated material and the satisfactory material ordered as replacement shall be included in excavation. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of in areas approved for surplus material storage or designated waste areas. Unsatisfactory excavated material shall be disposed of in designated waste or spoil areas. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

3.1.1 Ditches, Gutters, and Channel Changes

Excavation of ditches, gutters, and channel changes shall be accomplished by cutting accurately to the cross sections, grades, and elevations shown. Ditches and gutters shall not be excavated below grades shown. Excessive open ditch or gutter excavation shall be backfilled with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Material excavated shall be disposed of as shown or as directed, except that in no case shall material be deposited less than 1 meter (4 feet) from the edge of a ditch. The Contractor shall maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.1.2 Drainage Structures

Excavations shall be made to the lines, grades, and elevations shown, or as directed. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm, level, stepped, or serrated surface. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, the bottom of the excavation shall not be disturbed. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.2 SELECTION OF BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas shown or from other approved sources, either private or within the limits of the project site, selected by the Contractor. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

3.3 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.4 GRADING AREAS

Where indicated, work will be divided into grading areas within which satisfactory excavated material shall be placed in embankments, fills, and required backfills. The Contractor shall not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing.

3.5 BACKFILL

Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure. Ground surface on which backfill is to be placed shall be prepared as specified in paragraph PREPARATION OF GROUND SURFACE FOR EMBANKMENTS. Compaction requirements for backfill materials shall also conform to the applicable portions of paragraphs PREPARATION OF GROUND SURFACE FOR EMBANKMENTS, EMBANKMENTS, and SUBGRADE PREPARATION, and Section 02720 STORM-DRAINAGE SYSTEM; Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS and Section 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDING. Compaction and Section 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDING shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.6 PREPARATION OF GROUND SURFACE FOR EMBANKMENTS

Ground surface on which fill is to be placed shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; plowed, disked, or otherwise broken up to a depth of 6 inch; pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. The prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of embankment materials to assure adequate bond between embankment material and the prepared ground surface.

3.7 EMBANKMENTS

3.7.1 Earth Embankments

Earth embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 75 mm. (3 inches). The material shall be placed in successive horizontal layers of loose material not more than 203 millimeters (8 inches) in depth. Each

layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary and scarified or otherwise broken up in such a manner that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction requirements for the upper portion of earth embankments forming subgrade for pavements shall be identical with those requirements specified in paragraph SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.8 SUBGRADE PREPARATION

3.8.1 Construction

Subgrade shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 150 mm (6 inches) below finished grade for the subgrade. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified. After rolling, the surface of the subgrade for roadways shall not show deviations greater than 10 millimeter (3/8inch) when tested with 4 meter (12 foot) straight edge applied both parallel and at right angles to the centerline of the area. The elevation of the finish subgrade shall not vary more than 15 mm(0.05 foot) from the established grade and cross section.

3.8.2 Compaction

Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, each layer of the embankment shall be compacted to at least 95 percent of laboratory maximum density.

3.8.2.1 Subgrade for Pavements

Subgrade for pavements shall be compacted to at least 95 percentage laboratory maximum density for the depth below the surface of the pavement shown.

3.8.2.2 Subgrade for Shoulders

Subgrade for shoulders shall be compacted to at least 95 percentage laboratory maximum density for the depth below the surface of shoulder shown .

3.9 SHOULDER CONSTRUCTION

Shoulders shall be constructed of satisfactory excavated or borrow material

or as otherwise shown or specified. Shoulders shall be constructed as soon as possible after adjacent paving is complete, but in the case of rigid pavements, shoulders shall not be constructed until permission of the Contracting Officer has been obtained. The entire shoulder area shall be compacted to at least the percentage of maximum density as specified in paragraph SUBGRADE PREPARATION above, for specific ranges of depth below the surface of the shoulder. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Shoulder construction shall be done in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. The completed shoulders shall be true to alignment and grade and shaped to drain in conformity with the cross section shown.

3.10 FINISHING

The surface of excavations, embankments, and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for graded areas shall be within 30 mm (0.1 foot) of the grades and elevations indicated except that the degree of finish for subgrades shall be specified in paragraph SUBGRADE PREPARATION. Gutters and ditches shall be finished in a manner that will result in effective drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials.

3.11 TESTING

Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. The first inspection be at the expense of the Government. Cost incurred for any subsequent inspections required because of failure of the first inspection will be charged to the Contractor. Field in-place density shall be determined in accordance with ASTM D 1556 . When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompacted to meet specification requirements. Tests on recompacted areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.11.1 Fill and Backfill Material Gradation

One test per 1000 cubic yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C 136.

3.11.2 In-Place Densities

- a. One test per 1000 square feet, or fraction thereof, of each lift of

fill or backfill areas compacted by other than hand-operated machines.

- b. One test per 1000 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.
- c. One test per 100 linear feet, or fraction thereof, of each lift of embankment or backfill for roads.
- d. One test per 100 linear feet, or fraction thereof, of each lift of embankment or backfill for railroads.

3.11.3 Check Tests on In-Place Densities

If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 as follows:

- a. One check test per lift for each 5000 square feet, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.
- b. One check test per lift for each 5000 square feet, of fill or backfill areas compacted by hand-operated machines.
- c. One check test per lift for each 500 linear feet, or fraction thereof, of embankment or backfill for roads .

3.11.4 Moisture Contents

In the stockpile, excavation, or borrow areas, a minimum of two tests per day per type of material or source of material being placed during stable weather conditions shall be performed. During unstable weather, tests shall be made as dictated by local conditions and approved by the Contracting Officer.

3.11.5 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 1000 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.11.6 Tolerance Tests for Subgrades

Continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION shall be made during construction of the subgrades.

3.12 SUBGRADE AND EMBANKMENT PROTECTION

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained to drain effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until ballast, subbase, base, or pavement is placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. No subbase, base course, ballast,

or pavement shall be laid until the subgrade has been checked and approved, and in no case shall subbase, base, surfacing, pavement, or ballast be placed on a muddy, spongy, or frozen subgrade.

-- End of Section --

SECTION 02551

BITUMINOUS PAVING FOR ROADS, STREETS AND OPEN STORAGE AREAS
07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29	(1991a) Unit Weight and Voids in Aggregate
ASTM C 88	(1990) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	(1995) Materials Finer than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 127	(1988; R 1993) Specific Gravity and Absorption of Coarse Aggregate
ASTM C 128	(1993) Specific Gravity and Absorption of Fine Aggregate
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 183	(1995) Sampling and the Amount of Testing of Hydraulic Cement
ASTM D 5	(1994) Penetration of Bituminous Materials
ASTM D 75	(1987; R 1992) Sampling Aggregates
ASTM D 140	(1993) Sampling Bituminous Materials
ASTM D 242	(1995) Mineral Filler for Bituminous Paving Mixtures
ASTM D 422	(1963; R 1990) Particle-Size Analysis of Soils
ASTM D 946	(1982; R 1993) Penetration-Graded Asphalt Cement for Use in Pavement Construction

ASTM D 1250	(1980; R 1990) Petroleum Measurement Tables
ASTM D 1856	(1995a) Recovery of Asphalt from Solution by Abson Method
ASTM D 2041	(1995) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D 2172	(1995) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D 2216	(1992) Laboratory Determination of Water (Moisture) Content of Soil, and Rock
ASTM D 3381	(1992) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 3515	(1989) Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
ASTM D 4791	(1995) Flat or Elongated Particles in Coarse Aggregate

TEXAS STATE DEPARTMENT OF HIGHWAY AND PUBLIC TRANSPORTATION
STANDARD SPECIFICATION(TSDHPT)

TSDHPT-01	(1993) Standard Specification for Construction of Highway, Streets and Bridges
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NEW MEXICO DEPARTMENT OF HIGHWAY AND PUBLIC TRANSPORTATION STANDARD
SPECIFICATION(TSDHPT)

NMSDHPT	New Mexico state highway & bridges construction standard specifcation
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CORPS OF ENGINEERS HANDBOOK FOR CONCRETE AND CEMENT (COE)

COE-CRD-C 649-95	(1993)Standard Test Method for Unit Weight. Marshall Stability and Flow of Bituminous Mixtures
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COE-CRD-C 650-95	(1993)Standard Test Method for Density and percent voids in compacted Bituminous Paving Mixtures
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COE-CRD-C 652-92	(1993)Standard Test Method for Measurement or Reduction in Marshall Stability of
------------------	--

Bituminous Mixtures Cased by Immersion in
water

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Bituminous PavementGA.

Copies of test results.

SD-18 Records

Waybills and Delivery Tickets; FIO.

Waybills and delivery tickets, during progress of the work.

1.4 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.4.1 General

The bituminous plant shall be of such capacity to produce the quantities of bituminous mixtures required. Hauling equipment, paving machines, rollers, miscellaneous equipment, and tools shall be provided in sufficient numbers and capacity and in proper working condition to place the bituminous paving mixtures at a rate equal to the plant output.

1.4.3 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one 12-foot straightedge for each bituminous paver. Straightedge shall be made available for Government use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to insure rigidity and accuracy. Straightedges shall have handles to facilitate movement on pavement.

1.5 WEATHER LIMITATIONS

Unless otherwise directed, bituminous courses shall not be constructed when temperature of the surface of the existing pavement or base course is below (40 degrees F).

1.6 PROTECTION OF PAVEMENT

After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until the pavement has cooled to (40 degrees F)

1.7 GRADE AND SURFACE-SMOOTHNESS REQUIREMENTS

Finished surface of bituminous courses, when tested as specified below shall conform to gradeline and elevations shown and to surface-smoothness

requirements specified.

1.7.1 Plan Grade

The grade of the completed surface shall not deviate more than 0.05 foot from the plan grade.

1.7.2 Surface Smoothness

When a 12-foot straightedge is laid on the surface parallel with the centerline of the paved area or transverse from crown to pavement edge, the surface shall vary not more than 1/4 inch from the straightedge.

1.8 GRADE CONTROL

Lines and grades shall be established and maintained by means of line and grade stakes placed at site of work in accordance with the Special Contract Requirements. Elevations of bench marks used by the Contractor for controlling pavement operations at the site of work will be determined, established, and maintained by the Government. Finished pavement elevations shall be established and controlled at the site of work by the Contractor in accordance with bench mark elevations furnished by the Contracting Officer.

1.9 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the contractor, it shall be performed by and an approved commercial testing laboratory or by the Contractor subject to approval. Unless otherwise specified, sampling shall be in accordance with ASTM D 140 for bituminous material. Copies of test results shall be furnished to the Contracting Officer. Approval of source does not relieve the Contractor of responsibility for delivery at the job site of material meeting the requirements herein.

1.9.1 Test Required

1.9.1.1 Plant Mix

1.9.1.1 Hot Bin Gradation

Hot bin gradations (cold-feed gradation when drum mix plant is used), shall be tested in accordance with ASTM C 136 and ASTM C 117. A minimum of one test will be conducted per every 200 tons of wearing course mix placed or fraction thereof, and a minimum of one test conducted per every 350 tons of intermediate course mix placed or fraction thereof.

1.9.1.1.2 Marshall Specimens

Marshall Specimen shall be taken in accordance with CRD-C 652-95. At least one set of specimens shall be taken per 200 tons of wearing course mix placed, and one set of specimens shall be taken per each 350 tons of intermediate course mix placed. However, not less than two sets of specimens (three specimens per set) shall be taken in any one day regardless of the quantity of mix placed.

1.9.1.1.3 Asphalt Extraction

Asphalt extractions shall be performed in accordance with ASTM D 2172, method A or B. At least one asphalt extraction shall be conducted per day.

1.9.1.2 Field Density Test

Field Density Test shall be conducted in accordance with CRD-C 650-95. A minimum of one test will be conducted per every 200 tons of wearing course mix place or fraction thereof, and a minimum test conducted per every 350 tons of intermediate course mix placed or fraction thereof.

1.9.1.3 Thickness Measurements

Thickness measurements shall be taken at a minimum of one measurement for each 835 square meters of mix placed.

1.10 DELIVERY, STORAGE, AND HANDLING OF MATERIALS

1.10.1 Mineral Aggregates

Mineral aggregates shall be delivered to the site of the bituminous mixing plant and stockpiled in such manner as to preclude fracturing of aggregate particles, segregation, contamination, or intermingling of different materials in the stockpiles or cold-feed hoppers. Mineral filler shall be delivered, stored, and introduced into the mixing plant in a manner to preclude exposure to moisture or other detrimental conditions.

1.10.2 Bituminous Materials

Bituminous materials shall be maintained at appropriate temperature during storage but shall not be heated by application of direct flame to walls of storage tanks or transfer lines. Storage tanks, transfer lines, and weigh buckets shall be thoroughly cleaned before a different type or grade of bitumen is introduced into the system. The asphalt cement shall be heated sufficiently to allow satisfactory pumping of the material; however, the storage temperature shall be maintained below 300 degrees F.

1.11 ACCESS TO PLANT AND EQUIPMENT

The Contracting Officer shall have access at all times to all parts of the paving plant for checking adequacy of the equipment in use; inspecting operation of the plant; verifying weights, proportions, and character of materials; and checking temperatures maintained in preparation of the mixtures.

1.12 WAYBILLS AND DELIVERY TICKETS

Before the final statement is allowed, the Contractor shall file with the Contracting Officer certified waybills and certified delivery tickets for all aggregates and bituminous materials actually used in construction.

PART 2 PRODUCTS

2.1 Hot Mix Surface Course

Bituminous hot-mix surface course shall conform to the requirements of TSDBT-01 for "Hot Mix Asphaltic Concrete Pavement", item 340, except as specified hereinafter.

2.1.1 Asphalt Material

Asphalt material for the surface course shall be asphalt cement AC-20 conforming to ASTM D 3381. Asphalt material shall come from a source approved for use by the NMSHBC. The seal number from the tank and the number of the NMSHBC Laboratory test report shall be furnished to the Contracting Officer.

2.1.2 Paving Mixture

Paving mixture shall be Type "D".

2.1.3 State Specification Modification

TSDHPT Specification shall be modified as follows:

- a. Material retained on the 2mm size sieve shall not exceed 65 percent.
- b. Density and stability requirements shall not apply.
- c. Construction method paragraph shall not apply.
- d. The measurement and payment paragraphs shall not apply.

2.2 PROPORTIONING OF MIXTURE

2.2.1 Job Mix Formula(JMF)

The JMF for the bituminous mixture will be furnished the Contracting officer for approval. No payment will be made for mixture produced prior to the approval of the JMF. The formula will indicate the percentage of each stockpiled and mineral filler, the percentage of each size aggregate, the percentage of bitumen, and the temperature of the specified in NMSHBC will be allowed for asphalt content temperature, and aggregate grading for tests conducted on the mix as discharged for the mixing plant aggregate gradation and asphalt content will be based on Part 3 paragraph Bituminous mix that deviates more than 4 degrees C from the JMF shall be rejected. The JMF may be adjusted during construction to improve paving mixtures, as directed, without adjustments in contract prices.

2.2.2 Test Properties of Bituminous Mixtures

Finished mixture shall meet requirements described below when tested in accordance with CRD-C 649-95. All samples will be compacted with 50 blows of specified hammer on each side of sample. When bituminous mixture fails to meet the requirements specified below, the paving operation shall be stopped until the cause of noncompliance is determined and corrected.

2.2.2.1 Stability, Flow, and Voids

Requirements for stability, flow, and voids are shown in TABLES III and IV for nonabsorptive and absorptive aggregates, respectively.

TABLE I NONABSORPTIVE-AGGREGATE MIXTURE

TABLE I NONABSORPTIVE-AGGREGATE MIXTURE

	Wearing Course	Intermediate Course
	Wearing Course	Intermediate Course
Stability minimum, newtons	2200	2200
Flow maximum, 25/100-millimeter units	20	20
Voids total mix, percent (1)	3-5	4-6
Voids filled with bitumen, percent (2)	75-85	65-75

(1) The Contracting Officer may permit deviations from limits specified when gyratory method of design is used to develop the JMF.

(2) The Contracting Officer may permit deviation from limits specified for voids filled with bitumen in the intermediate course in order to stay within limits for percent voids total mix.

TABLE II ABSORPTIVE-AGGREGATE MIXTURE

	Wearing Course	Intermediate Course
	Wearing Course	Intermediate Course
Stability minimum, pounds	2200	2200
Flow maximum, 25/100-millimeter units	20	20
Voids total mix, percent (1)	2-4	3-5
Voids filled with bitumen, percent (2)	80-90	70-80

(1) The Contracting Officer may permit deviations from limits specified when gyratory method of design is used to develop the JMF.

(2) The Contracting Officer may permit deviation from limits specified for voids filled with bitumen in the intermediate course in order to stay within limits for percent voids total mix.

- a. When the water-absorption value of the entire blend of aggregate does not exceed 2.5 percent as determined in accordance with ASTM C 127 and ASTM C 128, the aggregate is designated as nonabsorptive. The theoretical specific gravity computed from the apparent specific gravity or ASTM D 2041 will be used in computing voids total mix and voids filled with bitumen, and the mixture shall meet requirements in TABLE I.
- b. When the water-absorption value of the entire blend of aggregate exceeds 2.5 percent as determined in accordance with ASTM C 127 and ASTM C 128, the aggregate is designated as absorptive. The theoretical specific gravity computed from the bulk-impregnated specific gravity method contained in ASTM D 2041 shall be used in computing percentages of voids total mix and voids filled with bitumen; the mixture shall meet requirements in TABLE II.

2.2.2.2 Stability

The index of retained stability must be greater than 75 percent as determined by CRD-C 652-95. When the index of retained stability is less than 75, the aggregate stripping tendencies may be countered by the use of hydrated lime or by treating the bitumen with an approved antistripping agent. The hydrated lime is considered as mineral filler and should be considered in the gradation requirements. The amount of hydrated lime or antistripping agent added to bitumen shall be sufficient, as approved, to produce an index of retained stability of not less than 75 percent. No additional payment will be made to the Contractor for addition of antistripping agent required.

PART 3 EXECUTION

3.1 BASE COURSE CONDITIONING

The surface of the base course will be inspected for adequate compaction and surface tolerances specified in Section 02721. Unsatisfactory areas shall be corrected.

3.3 PREPARATION OF BITUMINOUS MIXTURES

Rates of feed of aggregates shall be regulated so that the moisture content and temperature of aggregates will be within specified tolerances. Aggregates, mineral filler, and bitumen shall be conveyed into the mixer in proportionate quantities required to meet the JMF. Mixing time shall be as required to obtain a uniform coating of the aggregate with the bituminous material. Temperature of bitumen at time of mixing shall not exceed 300 degrees F. Temperature of aggregate and mineral filler in the mixer shall not exceed 325 degrees F when bitumen is added. Overheated and carbonized mixtures or mixtures that foam shall not be used.

3.4 WATER CONTENT OF AGGREGATES

Drying operations shall reduce the water content of mixture to less than 0.75 percent. The water content test will be conducted in accordance with ASTM D 2216; the weight of the sample shall be at least 500 grams. If the water content is determined on hot bin samples, the water content will be a weighted average based on composition of blend.

3.5 STORAGE OF BITUMINOUS PAVING MIXTURE

Storage shall conform to the applicable requirements of ASTM D 3515; however, in no case shall the mixture be stored for more than 4 hours.

3.6 TRANSPORTATION OF BITUMINOUS MIXTURE

Transportation from paving plant to site shall be in trucks having tight, clean, smooth beds lightly coated with an approved releasing agent to prevent adhesion of the mixture to the truck bodies. Excessive releasing agent shall be drained prior to loading. Each load shall be covered with canvas or other approved material of ample size to protect mixture from weather and to prevent loss of heat. Loads that have crusts of cold, unworkable material or that have become wet will be rejected. Hauling over freshly placed material will not be permitted.

3.7 SURFACE PREPARATION OF UNDERLYING COURSE

Prior to placing of the intermediate or wearing course, the underlying course shall be cleaned of all foreign or objectionable matter with power brooms and hand brooms.

3.8 PRIME COATING

Surfaces of previously constructed base course shall be sprayed with a coat of bituminous material conforming to NMSHBC Standard for BITUMINOUS PRIME COAT.

3.9 TACK COATING

Contact surfaces of previously constructed pavement, curbs, manholes, and other structures shall be sprayed with a thin coat of bituminous material conforming to NMSHBC Standard for BITUMINOUS TACK COAT.

3.10 PLACING

Bituminous courses shall be constructed only when the base course or existing pavement has no free water on the surface. Bituminous mixtures shall not be placed without ample time to complete spreading and rolling during daylight hours, unless approved satisfactory artificial lighting is provided.

3.10.1 Offsetting Joints

The wearing course shall be placed so that longitudinal joints of the wearing course will be offset from joints in the intermediate course by at least 1 foot. Transverse joints in the wearing course shall be offset by at least 2 feet from transverse joints in the intermediate course.

3.10.2 General Requirements for Use of Mechanical Spreader

Range of temperatures of mixtures, when dumped into the mechanical spreader, shall be as determined by the Contracting Officer. Mixtures having temperatures less than 225 degrees F when dumped into the mechanical spreader shall not be used. The mechanical spreader shall be adjusted and the speed regulated so that the surface of the course being laid will be smooth and continuous without tears and pulls, and of such depth that, when compacted, the surface will conform to the cross section indicated. Placing with respect to center line areas with crowned sections or high side of areas with one-way slope shall be as directed. Placing of the mixture shall be as nearly continuous as possible, and speed of placing shall be adjusted, as directed, to permit proper rolling. When segregation occurs in the mixture during placing, the spreading operation shall be suspended until the cause is determined and corrected.

3.10.3 Placing Strips Succeeding Initial Strips

In placing each succeeding strip after initial strip has been spread and compacted as specified below, the screed of the mechanical spreader shall overlap the previously placed strip 2 to 3 inches and be sufficiently high so that compaction produces a smooth dense joint. Mixture placed on the edge of a previously placed strip by the mechanical spreader shall be pushed back to the edge of the strip by use of a lute. Excess mixture

shall be removed and wasted.

3.10.4 Handspreading in Lieu of Machine Spreading

In areas where the use of machine spreading is impractical, the mixture shall be spread by hand. Spreading shall be in a manner to prevent segregation. The mixture shall be spread uniformly with hot rakes in a loose layer of thickness that, when compacted, will conform to required grade, density, and thickness.

3.11 COMPACTION OF MIXTURE

Rolling shall begin as soon after placing as the mixture will bear a roller without undue displacement. Delays in rolling freshly spread mixture will not be permitted. After initial rolling, preliminary tests of crown, grade, and smoothness shall be made by the Contractor. Deficiencies shall be corrected so that the finished course will conform to requirements for grade and smoothness specified herein. Crown, grade, and smoothness will be checked in each lot of completed pavement by the Contracting Officer. After the Contractor is assured of meeting crown, grade, and smoothness requirements, rolling shall be continued until a mat density of 97.0 to 100.0 percent and a joint density of 95.0 to 100.0 percent of density of laboratory-compacted specimens of the same mixture is obtained. Places inaccessible to rollers shall be thoroughly compacted with hot hand tampers.

3.11.2 Correcting Deficient Areas

Mixtures that become contaminated or are defective shall be removed to the full thickness of the course. Edges of the area to be removed shall be cut so that sides are perpendicular and parallel to the direction of traffic and so that the edges are vertical. Edges shall be sprayed with bituminous materials conforming to NMSHBC Standard for BITUMINOUS TACK and prime COAT. Fresh paving mixture shall be placed in the excavated areas in sufficient quantity so that the finished surface will conform to grade and smoothness requirements. Paving mixture shall be compacted to the density specified herein. Skin patching of an area that has been rolled shall not be permitted.

3.12 JOINTS

3.12.1 General

Joints between old and new pavements, between successive work days, or joints that have become cold (less than 175 degrees F) shall be made to insure continuous bond between the old and new sections of the course. All joints shall have the same texture and smoothness as other sections of the course. Contact surfaces of previously constructed pavements coated by dust, sand, or other objectionable material shall be cleaned by brushing or shall be cut back as directed. When directed by the Contracting Officer, the surface against which new material is placed shall be sprayed with a thin, uniform coat of bituminous material conforming to NMSHBC Standard for BITUMINOUS TACK and prime COAT. Material shall be applied far enough in advance of placement of a fresh mixture to insure adequate curing. Care shall be taken to prevent damage or contamination of the sprayed surface.

3.12.2 Transverse Joints

The roller shall pass over the unprotected end of a strip of freshly placed material only when placing is discontinued or delivery of the mixture is interrupted to the extent that the material in place may become cold. In all cases, prior to continuing placement, the edge of previously placed pavement shall be cut back to expose an even vertical surface for full thickness of the course. In continuing placement of a strip, the mechanical spreader shall be positioned on the transverse joint so that sufficient hot mixture will be spread to obtain a joint after rolling that conforms to the required density and smoothness specified herein.

3.12.3 Longitudinal Joints

Edges of a previously placed strip shall be prepared such that the pavement in and immediately adjacent to the joint between this strip and the succeeding strip meets the requirements for grade, smoothness, and density.

-- End of Section --

SECTION 02660

WATER SERVICE LINES
07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN RAILWAY ENGINEERING ASSOCIATION (AREA)

AREA-03	(1994) Manual for Railway Engineering (Fixed Properties): Chapter 1, Roadway and Ballast
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1993) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM B 88	(1993a) Seamless Copper Water Tube
ASTM D 1784	(1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(1993) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(1993) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(1993) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1993) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(1993) Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(1993) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2657	(1990) Heat-Joining Polyolefin Pipe and Fittings
ASTM D 2774	(1972; R 1983) Underground Installation of Thermoplastic Pressure Piping

ASTM D 2855	(1993) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM F 477	(1993) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.1	(1989) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3	(1992) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(1992) Hypochlorites
AWWA B301	(1992) Liquid Chlorine
AWWA C104	(1990) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids
AWWA C111	(1990) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C203	(1991) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C300	(1989) Reinforced Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids
AWWA C301	(1992) Prestressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids
AWWA C303	(1987; Errata Jan 1988) Reinforced Concrete Pressure Pipe, Steel Cylinder Type, Pretensioned, for Water and Other Liquids
AWWA C504	(1987) Rubber Seated Butterfly Valves
AWWA C651	(1992) Disinfecting Water Mains
AWWA C700	(1990; C700a) Cold-Water Meters -

Displacement Type, Bronze Main Case

AWWA C701 (1988) Cold-Water Meters - Turbine Type,
for Customer Service

AWWA C901 (1988; Errata) Polyethylene (PE) Pressure
Pipe and Tubing, 1/2 In. Through 3 In., for
Water Service

AWWA C902 (1988) Polybutylene (PB) Pressure Pipe and
Tubing, 1/2 In. Through 3 In., for Water

AWWA M23 (1980) Manual: PVC Pipe - Design and
Installation

ASBESTOS CEMENT PIPE PRODUCERS ASSOCIATION (ACPPA)

ACPPA-01 (1988) Recommended Work Practices for A/C
Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND
FITTINGS INDUSTRY (MSS)

MSS SP-80 (1987) Bronze Gate, Globe, Angle and Check
Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24 (1992) Installation of Private Fire Service
Mains and Their Appurtenances

NATIONAL SANITATION FOUNDATION (NSF)

NSF Std 14 (1965; Rev Nov 1990) Plastics Piping System
Components and Related Materials

1.2 GENERAL

This section covers water service lines, and connections to building
service at a point approximately (5 feet) outside buildings and structures
to which service is required.

1.2.1 Piping for Water Service Lines

Piping for water service lines less than 3 inches in diameter shall be
galvanized steel, polyvinyl chloride (PVC) plastic, polyethylene,
polybutylene, or copper tubing, unless otherwise shown or specified.

1.2.2 Sprinkler Supply Lines

Piping for water lines supplying sprinkler systems for building fire
protection shall conform to NFPA 24 from the point of connection with the
water distribution system to the building (5 foot) line.

1.2.3 Plastic Pipe

Plastic piping system components (PVC, polyethylene, polybutylene) intended

for transportation of potable water shall comply with NSF Std 14 and shall be legibly marked with their symbol.

1.2.4 Excavation, Trenching, and Backfilling for Water Lines

Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, except as modified herein.

1.4 MANUFACTURER'S REPRESENTATIVE

The Contractor shall negotiate to have a manufacturer's field representative present at the jobsite during the installation and testing of PE, RTRP, and/or RPMP pipe to provide technical assistance and to verify that the materials are being installed in accordance with the manufacturer's prescribed procedures. When the representative feels that the Contractor is installing and testing the PE, RTRP, and/or RPMP pipe in a satisfactory manner, certification shall be written to note which individuals employed by the Contractor are capable of properly installing the pipe. The field representative shall advise the Contractor of unsatisfactory conditions immediately when they occur. Such conditions include improper diameter of pipe ends, damaged interior liner, poorly prepared joints, improper curing of joints, moving pipe before joints are cured, bending pipe to follow abrupt changes in trench contours, leaving pipe ends open in trench overnight, not properly drying joints after rain storms, exceeding effective adhesive life, sharp objects in trench bed, backfill that could damage pipe, improper procedure for concrete encasement of pipe, omission of thrust blocks at changes in direction or any other conditions which could have an adverse effect on the satisfactory completion and operation of the piping system.

1.5 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Instructions

Installation; FIO

The manufacturer's recommendations for each material or procedure to be utilized.

SD-08 Statements

Waste Water Disposal Method; FIO

The method proposed for disposal of waste water from hydrostatic tests and disinfection, prior to performing hydrostatic tests.

Satisfactory Installation; GA.

A statement signed by the principal officer of the contracting firm stating that the installation is satisfactory and in accordance with the contract drawings and specifications and the manufacturer's prescribed procedures and techniques, upon completion of the project and before final acceptance.

SD-09 Reports

Bacteriological Disinfection; FIO

Test results from commercial laboratory verifying disinfection.

SD-13 Certificates

Manufacturer's Representative; FIO

The name and qualifications of the manufacturer's representative and written certification from the manufacturer that the representative is technically qualified in all phases of PE, RTRP, and/or RPMP pipe laying and jointing and experienced to supervise the work and train the Contractor's field installers, prior to commencing installation.

Installation; FIO

A statement signed by the manufacturer's field representative certifying that the Contractor's personnel are capable of properly installing the pipe on the project.

Meters; FIO

Manufacturer's certificate stating that each meter furnished has been tested for accuracy of registration and compliance with the accuracy and capacity requirements of the appropriate AWWA standard.

1.3 HANDLING

Pipe and accessories shall be handled so as to ensure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place.

1.6.1 Coated and Wrapped Steel Pipe

Coated and wrapped steel pipe shall be handled in conformance with AWWA C203.

1.6.2 Polyethylene (PE) Pipe

PE pipe, fittings, and accessories shall be handled in conformance with AWWA C901.

1.6.3 Miscellaneous Plastic Pipe and Fittings

Polyvinyl Chloride (PVC), Reinforced Thermosetting Resin Pipe (RTRP), and Reinforced Plastic Mortar Pressure (RPMP) pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325M.

PART 2 PRODUCTS

2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Reinforced and Prestressed Concrete Pipe

Steel-cylinder reinforced concrete pipe shall conform to AWWA C300, AWWA C301, or AWWA C303 and shall be designed to withstand a working pressure of not less than 1.03 MPa (150 psi) unless otherwise shown or specified.

2.1.1 Plastic Pipe

2.1.1.1 Polyethylene Plastic (PE)

Pipe, tubing, and heat-fusion fittings shall conform to AWWA C901.

2.1.1.3 Polyvinyl Chloride (PVC) Plastic Pipe

Pipe, couplings and fittings shall conform to ASTM D 1784, Class 12454B.

- a. Screw-Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 80. Pipe couplings when used, shall conform to ASTM D 2464.
- b. Elastomeric-Gasket Joint: Pipe shall conform to dimensional requirements of ASTM D 1785, Schedule 40, or ASTM D 2241. Couplings and fittings shall conform to iron pipe (I.P.S.) or cast iron outside diameter (CIOD) size dimensions.

SDR	Maximum Working Pressure(MPa)	Minimum Hydrostatic Pressure (MPa)
26	0.689	0.917
21	0.827	1.103
17	1.034	1.379
13.5	1.379	1.834

SDR	Maximum Working Pressure (psi)	Minimum Hydrostatic Pressure (psi)

Maximum Working	Minimum	
26	100	133
21	120	160
17	150	200
13.5	200	266

c. Solvent Cement Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241.

d. Pipe (4 inch) through (12 Inch)
Diameter: Pipe, couplings and fittings shall conform to AWWA C900, Class 150, CIOD pipe dimensions, elastomeric-gasket joint, unless otherwise shown or specified.

E. Pipe (14 Inch) through (36 Inch)
Diameter: Pipe shall conform to AWWA C905 unless otherwise shown or specified.

2.1.3 Reinforced Plastic Mortar Pressure (RPMP) Pipe

AWWA C950

2.1.4 Reinforced Thermosetting Resin Pipe (RTRP)

Pipe shall have a quick-burst strength greater than or equal to four times the normal working pressure of the pipe. The quick-burst strength test shall conform to the requirements of ASTM D 1599.

2.1.4.1 RTRP-I

RTRP-I shall conform to ASTM D 2996, except pipe shall have an outside diameter equal to cast iron outside diameter or standard weight steel pipe. The pipe shall be suitable for a normal working pressure of 150 psi at 73 degrees F. The inner surface of the pipe shall have a smooth uniform continuous resin-rich surface liner conforming to ASTM D 2996.

2.1.4.2 RTRP-II

RTRP-II shall conform to ASTM D 2997. Pipe shall have an outside diameter equal to standard weight steel pipe.

2.1.5 Ductile-Iron Pipe

Ductile-iron pipe shall conform to AWWA C151, working pressure not less than 150 psi, unless otherwise shown or specified. Pipe shall be cement-mortar lined in accordance with AWWA C104. Linings shall be standard. When installed underground, pipe shall be encased with 3 mil thick polyethylene in accordance with AWWA C105. Flanged ductile iron pipe with threaded flanges shall be in accordance with AWWA C115.

2.1.6 Steel Pipe

2.1.6.1 Pipe Not Galvanized

Steel pipe, not galvanized, shall conform to AWWA C200 with dimensional requirements as given in ASME B36.10M for pipe (6 inches) in diameter and larger, and ASTM A 53 for smaller sizes.

Pipe shall be welded or seamless with plain or shouldered and grooved ends in accordance with AWWA C606 for use with mechanical couplings or bell-and-spigot ends with rubber gaskets. Bell-and-spigot ends for sizes less than diameter shall be as required by AWWA C200. The minimum wall thickness of the various sizes of pipe shall be as follows:

Pipe Sizes	Thickness
AS REQUIRED	AS REQUIRED

2.1.6.2 Galvanized-Steel Pipe

Galvanized-steel pipe shall conform to ASTM A 53, standard weight.

2.1.6.3 Protective Materials for Steel Pipe

Protective materials for steel pipe, except as otherwise specified, shall be mechanically applied in a factory or plant especially equipped for the purpose. The materials shall, unless otherwise indicated on the drawings, consist of the following for the indicated pipe material and size:

a. Pipe and fittings less than (3 inches) in diameter shall be thoroughly cleaned of foreign material by wire brushing and solvent cleaning, and then given one coat of coal-tar primer and two coats of coal-tar enamel conforming to AWWA C203; threaded ends of pipe and fittings shall be adequately protected prior to coating.

b. Pipe (3 Inches) or Larger, Not Galvanized:

(1) Cement-mortar coating and lining shall conform to and shall be applied in conformity with AWWA C205. Cement-mortar coating and linings shall not be used for pipe less than (4 inches) in diameter.

(2) Coal-tar enamel lining, coating and wrapping shall conform to AWWA C203 for materials, method of application, tests and handling. Non-asbestos material shall be used for the outerwrap.

(3) Cement-mortar lining, in lieu of coal-tar enamel lining, may be used with coal-tar enamel coating and wrapping. Cement-mortar lining shall conform to and shall be applied in conformity with AWWA C205.

2.1.7 Copper Tubing

Copper tubing shall conform to ASTM B 88, Type K, annealed

2.2 FITTINGS AND SPECIALS

2.2.1 Reinforced Concrete Pipe

Fittings and specials required for closures, curves, bends, branches and connections to valves, pipe, or structures shall be approved by the Contracting Officer and conform to the details furnished by the manufacturer and to AWWA C300, AWWA C301, or AWWA C303 as applicable.

2.2.2 Polyvinyl Chloride (PVC) Pipe

- a. For pipe less than diameter, fittings for threaded pipe shall conform to requirements of ASTM D 2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings, fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467, and fittings for elastomeric-gasket joint pipe shall be iron conforming to AWWA C110 or AWWA C111. Iron fittings and specials shall be cement-mortar lined standard thickness in accordance with AWWA C104.
- b. For pipe 4 inch diameter and larger, fittings and specials shall be iron, bell end in accordance with AWWA C110, 150 psi pressure rating unless otherwise shown or specified, except that profile of bell may have special dimensions as required by the pipe manufacturer; or may be fittings and specials of the same material as the pipe with elastomeric gaskets, all in conformance with AWWA C900. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104. Fittings shall be bell and spigot or plain end pipe, or as applicable. Ductile iron compact fittings shall be in accordance with AWWA C153.

2.2.3 RTRP and RPMP Pipe

Fittings and specials shall be compatible with the pipe supplied. Filament wound or molded fittings up to 6 inches shall conform to AWWA C950. Iron fittings shall be cement-mortar lined in accordance with AWWA C104 and shall conform to AWWA C110 and AWWA C111. Fittings shall be suitable for working and testing pressures specified for the pipe.

2.2.4 Ductile-Iron Pipe

Fittings and special shall be suitable for 150 psi pressure rating, unless otherwise specified. Fittings and specials for mechanical joint pipe shall conform to AWWA C110. Fittings and specials for use with push-on joint pipe shall conform to AWWA C110 and AWWA C111. Fittings and specials for grooved and shouldered end pipe shall conform to AWWA C606. Fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104. Ductile iron compact fittings shall conform to AWWA C153.

2.2.5.1 Steel Pipe Not Galvanized

Fittings and specials shall be made of the same material as the pipe. Specials and fittings may be made of standard steel tube turns or segmentally welded sections, with ends to accommodate the type of couplings or joints specified for the pipe. Dimensions of steel-pipe fittings shall be in accordance with AWWA C208. The thickness and pressure rating of pipe fittings and specials shall be not less than the thickness specified and the pressure rating calculated for the pipe with which they are used. Protective materials for fittings and specials shall be as specified for the pipe. Specials and fittings that cannot be mechanically lined, coated, and wrapped shall be lined, coated, and wrapped by hand, using the same material used for the pipe with the same number of applications of each material carefully and smoothly applied.

2.2.5.2 Galvanized-Steel Pipe

Steel fittings shall be galvanized. Screwed fittings shall conform to ASME B16.3. Flanged fittings shall conform to AWWA C207.

2.2.5.3 Dielectric Fittings

Dielectric fittings shall be installed between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.

2.2.6 Copper Tubing

Fittings and specials shall be flared and conform to ASME B16.26.

2.3 JOINTS

2.3.1 Reinforced Concrete Pipe

Rubber-gasket joints shall be of the type using a bell-and-spigot joint design of steel. The gaskets shall conform to AWWA C300, AWWA C301, or AWWA C303, as applicable.

2.3.1 Polyvinyl Chloride (PVC) Pipe

Fittings for threaded pipe shall conform to requirements of ASTM D 2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings. Fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467, and fittings for elastomeric-gasket joint pipe shall be iron conforming to AWWA C110 or AWWA C111. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104.

2.4.1.1 Polyethylene (PE) and Polybutylene (PB) Pipe

Joints for pipe fittings and couplings shall be strong tight joints as specified for PE and PB in Paragraph INSTALLATION. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendation as approved by the Contracting Officer.

2.4.1.2 Polyvinyl Chloride Pipe

Joints, fittings, and couplings shall be as specified for PVC pipe. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendations as approved by the Contracting Officer.

2.3.4 RTRP

2.3.4.1 RTRP-I, Grade I and 2

Joints shall be bell and spigot with elastomeric gasket, mechanical coupling with elastomeric gasket, threaded and bonded coupling, or tapered bell and spigot with compatible adhesive. All RTRP-I materials shall be products of a single manufacturer.

2.3.4.2 RTRP-II, Grade 1 and 2

Joints shall be the bell and spigot type with elastomeric gasket, bell and spigot with adhesive, butt-jointed with adhesive bonded reinforced overlay, mechanical, flanged, threaded or commercially available proprietary joints, provided they are capable of conveying water at the pressure and

temperature of the pipe.

2.3.5 Ductile-Iron Pipe

- a. Mechanical joints shall be of the stuffing box type and shall conform to AWWA C111.
- b. Push-on joints shall conform to AWWA C111.
- c. Rubber gaskets and lubricant shall conform to the applicable requirements of AWWA C111.

2.3.6 Steel Pipe

2.3.6.1 Steel Pipe, Not Galvanized

- a. Mechanical couplings shall be as hereinafter specified.
- b. Bell-and-spigot joints for use with rubber gaskets shall conform to AWWA C200, as appropriate for the type of pipe. Rubber gaskets shall conform to applicable requirements of AWWA C200.
- c. Flanges shall conform to AWWA C207, and shall be used only in above ground installation or where shown on the drawings, or when approved.

2.3.6.2 Mechanical Couplings

Mechanical couplings for steel pipe shall be the sleeve type, or when approved, the split-sleeve type and shall provide a tight flexible joint under all reasonable conditions, such as pipe movements caused by expansion, contraction, slight setting or shifting in the ground, minor variations in trench gradients, and traffic vibrations. Couplings shall be of strength not less than the adjoining pipeline.

2.3.7 Bonded Joints

For all ferrous pipe, a metallic bond shall be provided at each joint, including joints made with flexible couplings, caulking, or rubber gaskets, of ferrous-metallic piping to effect continuous conductivity. The bond wire shall be Size 1/0 copper conductor suitable for direct burial shaped to stand clear of the joint. The bond shall be of the thermal weld type.

2.3.8 Isolation Joints

Isolation joints shall be installed between nonthreaded ferrous and nonferrous metallic pipe, fittings and valves. Isolation joints shall consist of a sandwich-type flange isolation gasket of the dielectric type, isolation washers, and isolation sleeves for flange bolts. Isolation gaskets shall be full faced with outside diameter equal to the flange outside diameter. Bolt isolation sleeves shall be full length. Units shall be of a shape to prevent metal-to-metal contact of dissimilar metallic piping elements.

- a. Sleeve-type couplings shall be used for joining plain end pipe sections. The two couplings shall consist of one steel middle ring, two steel followers, two gaskets, and the necessary steel bolts and nuts to compress the gaskets.
- b. Split-sleeve type couplings may be used in aboveground installations when approved in special situations and shall consist of gaskets and a housing in two or more sections with the necessary bolts and nuts.

2.4.4 Isolation Joints

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- b. Split-sleeve type couplings may be used in aboveground installations when approved in special situations and shall consist of gaskets and a housing in two or more sections with the necessary bolts and nuts.

2.4.5 Copper Tubing

Joints shall be compression-pattern flared and shall be made with fittings specified.

2.4.6 Valves

2.4.6.1 Check Valves

Check valves shall be designed for a minimum working pressure of 150 psi or as indicated. Valves shall have a clear waterway equal to the full nominal diameter of the valve. Valves shall open to permit flow when inlet pressure is greater than the discharge pressure, and shall close tightly to prevent return flow when discharge pressure exceeds inlet pressure. The size of the valve, working pressure, manufacturer's name, initials, or trademark shall be cast on the body of each valve.

- a. Valves 2 inches and smaller shall be all bronze designed for screwed fittings, and shall conform to MSS SP-80, Class 150, Types 3 and 4 as suitable for the application.
- b. Valves larger than 2 inches shall be iron body, bronze mounted, shall have flanged ends, and shall be the non-slam type. Flanges shall conform to ASME B16.1, Class 125.

2.4.6.2 Gate Valves

Gate valves shall be designed for a working pressure of not less than 150 psi. Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening. Valves smaller than 3 inches shall be all bronze and shall conform to MSS SP-80, Type 1, Class 150.

2.4.6.3 Vacuum and Air Relief Valves

Vacuum and air relief valves shall be of the size shown and shall be of a type that will release air and prevent the formation of a vacuum. The valves shall automatically release air when the lines are being filled with water and shall admit air into the line when water is being withdrawn in excess of the inflow. Valves shall be iron body with bronze trim and stainless steel float.

2.4.6.4 Indicator Post for Valves

Each valve shown on the drawings with the designation "P.I.V." shall be equipped with indicator post conforming to the requirements of NFPA 24. Operation shall be by a wrench which will be attached to each post.

2.5 FIRE HYDRANTS

Hydrants shall be dry-barrel type conforming to AWWA C502 with valve opening at least (5 inches) in diameter and designed so that the flange at the main valve seat can be removed with the main valve seat apparatus remaining intact, closed and reasonably tight against leakage and with a breakable valve rod coupling and breakable flange connections located no more than 8 inches above the ground grade. Hydrants shall have a 6 inch bell connection, two 2-1/2 inch hose connections and one 4-1/2 inch pumper connection. Outlets shall have American National Standard fire-hose coupling threads. Working parts shall be bronze. Design, material, and workmanship shall be similar and equal to the latest stock pattern ordinarily produced by the manufacturer. Hydrants shall be painted with one coat of red iron oxide, zinc oxide primer conforming to SSPC Paint 25 and two finish coats of silicone alkyd paint conforming to SSPC Paint 21, color in accordance with NFPA recommendations. Suitable bronze adapter for the each outlet, with caps, shall be furnished.

2.6 FIRE-HYDRANT HOSE HOUSES

Hose houses conforming to the requirements of NFPA 24 shall be furnished at each fire hydrant indicated on the drawings to have a fire-hydrant hose house. The following equipment, in addition to that listed in NFPA 24, paragraph 5-6.1, shall be furnished with each hose house:

200 feet of 2-1/2 inch, woven jacketed, rubber lined hose conforming to NFPA 1961 with a minimum service test pressure of 300 psi. 100 feet of 1-1/2 inch, woven jacketed, rubber lined hose conforming to NFPA 1961 with a minimum service test pressure of 300 psi. (300 psi.)

One gated 2-1/2 inch by 1-1/2 inch by wye. One playpipe for 2-1/2 inch hose with 1 inch shutoff nozzle tip. One playpipe for 1-1/2 inch hose with shutoff nozzle or combination nozzle. Two adapter fittings, (2-1/2 inch) to 1-1/2 inch. Two spanners for 1-1/2 inch hose.

2.7 MISCELLANEOUS ITEMS

2.7.1 Service Clamps

Service clamps shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a galvanized malleable-iron body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

2.7.2 Goosenecks

Copper tubing for gooseneck connections shall conform to the applicable requirements of ASTM B 88, Type K, annealed. Length of cable requirement connections shall be in accordance with standard practice.

2.7.3 Service Stops

Service stops shall be water-works inverted-ground-key type, oval or round flow way, tee handle, without drain. Pipe connections shall be suitable for the type of service pipe used. All parts shall be of bronze with female iron-pipe-size connections or compression-pattern flared tube couplings, and shall be designed for a hydrostatic test pressure not less than 200 psi.

2.7.4 Tapping Sleeves

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, or malleable-iron, split-sleeve type with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 150 psi.. Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, the tee shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pretorqued to 50 foot-pound.

2.7.5 Service Boxes

Service boxes shall be cast iron or concrete and shall be extension service boxes of the length required for the depth of the line, with either screw or slide-type adjustment. The boxes shall have housings of sufficient size to completely cover the service stop or valve and shall be complete with identifying covers.

2.7.6 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Cutting of Pipe

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contracting Officer, cutting shall be done with an

approved type mechanical cutter. Wheel cutter shall be used when practicable. Copper tubing shall be cut square and all burrs shall be removed. Squeeze type mechanical cutters shall not be used for ductile iron.

3.1.2 Adjacent Facilities

3.1.2.1 Sewer Lines

Where the location of the water pipe is not clearly defined in dimensions on the drawings, the water pipe shall not be laid closer horizontally than 10 feet from a sewer except where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 6 feet from the sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe for a distance of at least 10 feet each side of the crossing shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 3 feet horizontally of the crossing. Water lines shall in all cases cross above sewage force mains or inverted siphons and shall be not less than 2 feet above the sewer main. Joints in the sewer main, closer horizontally than 3 feet to the crossing, shall be encased in concrete.

3.1.2.2 Water Lines

Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

3.1.2.3 Copper Tubing

Copper tubing shall not be installed in the same trench with ferrous piping materials.

3.1.2.4 Nonferrous Metallic Pipe

Where copper tubing crosses any ferrous piping material, a minimum vertical separation of 12 inches shall be maintained between pipes.

3.1.2.5 Structures

Where water pipe is required to be installed within 3 feet of existing structures, the water pipe shall be sleeved as required for roads, railroads, and airfields. Care shall be exercised and proper precautions taken during installation of the water pipe and sleeve to assure that there will be no damage to the structures and no settlement or movement of foundations or footings.

3.1.3 Reinforced Concrete Pipe

Maximum allowable deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets, shall be 5 degrees for reinforced concrete pipe unless a lesser amount is recommended by the manufacturer. Long radius curves in reinforced concrete pipe shall be formed by straight pipe in which spigot rings are placed on a bevel. Slight deflections may be made by straight pipe, provided that the maximum joint opening caused by such deflections does not exceed the maximum recommended by the pipe manufacturer. Short-radius curves and closures

shall be formed by shorter lengths of pipe, bevels, or fabricated specials specified.

3.1.3.1 Flexible Plastic Pipe

Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer, but in no case shall it exceed 5 degrees.

3.1.3.2 Ductile-Iron Pipe

The maximum allowable deflection shall be as given in AWWA C600. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.

3.1.3.3 Steel Pipe

For pipe with bell-and-spigot rubber-gasket joints, maximum allowable deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets shall be 5 degrees unless a lesser amount is recommended by the manufacturer. Short-radius curves and closures shall be formed by short lengths of pipe or fabricated specials specified.

3.1.4 Placing and Laying

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. The water-line materials shall not be dropped or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating. Except where necessary in making connections with other lines or as authorized by the Contracting Officer, pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until joints are complete. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored, as shown.

3.1.4.1 Reinforced Concrete Pipe Installation

Reinforced concrete pipe shall be installed in accordance with recommendations of the pipe manufacturer. Before laying reinforced concrete pipe, the outside surface of the spigot and the inside surface of the bell shall be cleaned and an acceptable vegetable-compound lubricant applied to the inside surface of the bell and to the rubber gasket. Where prescribed by the pipe manufacturer, the gasket shall be placed in the groove on the end of the pipe before the pipe is placed in the trench. After the pipe has been forced together, the position of the rubber gasket shall be checked with a feeler gauge in accordance with the pipe manufacturer's recommendations. Tapping of reinforced concrete cylinder pipe shall be done in accordance with the manufacturer's approved recommendations. Where the manufacturer recommends that the taps be made by attaching the rubber-gasketed saddle to the outside of the pipe using U-bolts, the saddle shall be grouted in if necessary, the mortar coating

shall be chipped away even with the hole in the saddle plate. The exposed circumferential wires shall be removed and the cylinder and concrete core drilled out, and the steel saddle and U-bolts shall be protected by concrete encasement.

3.1.4.2 Plastic Pipe Installation

RTRP shall be installed in accordance with ASTM D 3839. RPMP shall be installed in accordance with the recommendations of the manufacturer. PE Pipe shall be installed in accordance with ASTM D 2774. PVC pipe shall be installed in accordance with AWWA M23.

3.1.4.3 Connections

Where connections are made between new work and existing mains, the connections shall be made by using specials and fittings to suit the actual conditions. When made under pressure, these connections shall be installed using standard methods as approved by the Contracting Officer. Connections to existing asbestos-cement pipe shall be made in accordance with ACPPA-01.

3.1.4.4 Penetrations

Pipe passing through walls of valve pits and structures shall be provided with ductile-iron or Schedule 40 steel wall sleeves. Annular space between walls and sleeves shall be filled with rich cement mortar. Annular space between pipe and sleeves shall be filled with mastic.

3.1.4.5 Flanged Pipe

Flanged pipe shall only be installed above ground or with the flanges in valve pits.

3.1.5 Jointing

3.1.5.1 Reinforced-Concrete Pipe

The inside and outside annular spaces between abutting sections of concrete pipe shall be filled with rich cement mortar in accordance with the recommendations of the pipe manufacturer. Excess mortar shall be removed from interior annular spaces, leaving a smooth and continuous surface between pipe sections. Exposed portions of steel joint rings shall be protected from corrosion by a metallic coating or by an approved nonmetallic coating. Rubber gaskets shall be handled, lubricated where necessary, and installed in accordance with the recommendations of the pipe manufacturer.

3.1.5.2 Polyethylene (PE) Pipe

Jointing shall comply with ASTM D 2657, Technique I-Socket Fusion or Technique II-Butt Fusion.

3.1.5.3 Polyvinyl Chloride (PVC) Plastic Pipe

a. Pipe less than 4 inch diameter: Threaded joints shall be made by wrapping the male threads with approved thread tape or applying an approved lubricant, then threading the joining members

together. The joint shall be tightened using strap wrenches to prevent damage to the pipe and/or fitting. To avoid excessive torque, joints shall be tightened no more than one thread past hand-tight. Preformed rubber-ring gaskets for elastomeric-gasket joints shall be made in accordance with requirements of ASTM F 477 and as required herein. All pipe ends for push-on joints shall be beveled to facilitate assembly and marked to indicate when the pipe is fully seated. The gasket shall be prelubricated to prevent displacement. The gasket and ring groove in the bell or coupling shall match. The manufacturer of the pipe or fitting shall supply the elastomeric gasket. Couplings shall be provided with stops or centering rings to assure that the coupling is centered on the joint. Solvent cement joints shall use sockets conforming to the requirements of ASTM D 2467. The solvent cement used shall meet the requirements of ASTM D 2564; the joint assembly shall be made in accordance with ASTM D 2855 and the manufacturer's specific recommendations.

b. Pipe 4 inch through 12 inch diameter: Joints shall be elastomeric-gasket as specified in AWWA C900. Jointing procedure shall be as specified for pipe less than 100 mm (4 inch) diameter with configuration using elastomeric ring gasket.

c. Pipe 14 inch through 36 inch (36 inch) diameter: Joints shall be elastomeric-gasket push-on joints made in accordance with AWWA M23.

3.1.5.4 RTRP I, RTRP II and RPMP Pipe

a. RTRP I: Assembly of the pipe shall be done in strict conformance with the manufacturer's written instruction and installation procedures. Field joints shall be prepared as specified by the pipe manufacturer. Several pipe joints having interference-fit type couplings may be field bonded and cured simultaneously. However, the pipe shall not be moved nor shall additional joints be made until the previously laid joints are completely cured. Joints not having interference-fit type coupling shall be fitted with a clamp which shall hold the joint rigidly in place until the joint cement has completely cured. The clamps shall have a protective material on the inner surface to prevent damage to the plastic pipe when the clamp is tightened in place. The pipe manufacturer shall provide a device or method to determine when the joint is pulled against the pipe stop. Additionally, the pipe manufacturer shall furnish a gauge to measure the diameter of the spigot ends to ensure the diameter conforms to the tolerances specified by the manufacturer. All pipe ends shall be gauged. Factory certified tests shall have been satisfactorily performed to verify that short-term rupture strength is 1,500 psi or greater when carried out in accordance with ASTM D 1599. All field bonded epoxy-cemented joints, regardless of ambient temperature, shall be cured with a self-regulating thermostatically temperature controlled electrical heating blanket for the time and temperature recommended by the manufacturer for the applicable size and type of joint, or by an alternate heating method recommended by the manufacturer and approved by the Contracting Officer. The joint sections shall not be moved during heating or until the joint has cooled to ambient temperature.

b. RTRP II: A reinforced overlay joint shall be used to join sections together through a placement of layers of reinforcement fiberglass roving, mat, tape or fabric thoroughly saturated with compatible catalyzed resin.

c. Fittings and Specials for RTRP and RPMP Pipe: Metal to RTRP and RPMP pipe connections shall be made by bolting steel flanges to RTRP and

RPMP pipe flanges. Cast-iron fitting with gasket bell or mechanical joint may be used with RTRP if pipe has cast iron outside diameter. Steel flanges shall be flat-faced type. Where raised-face steel flanges are used, spacer rings shall be used to provide a flat-face seat for RTRP and RPMP pipe flanges. A full-face Buna "N" gasket 1/8 inch thick with a shore hardness of 50-60 shall be used between all flanged connections. The RTRP and RPMP pipe flange shall have raised sealing rings. Flat washers shall be used under all nuts and bolts on RTRP and RPMP pipe flanges. Bolts and nuts shall be of noncorrosive steel and torqued to not more than 135 Newton meters. (100 foot pounds.) Flanges shall not be buried. A concrete pit shall be provided for all flanged connections.

3.1.5.5 Ductile-Iron Pipe

Mechanical and push-on type joints shall be installed in accordance with AWWA C600 for buried lines or AWWA C606 for grooved and shouldered pipe above ground or in pits.

3.1.5.6 Steel Pipe, Not Galvanized

- a. Mechanical Couplings: Mechanical couplings shall be installed in accordance with the recommendations of the couplings manufacturer.
- b. Rubber Gaskets: Rubber gaskets shall be handled, lubricated where necessary, and installed in accordance with the recommendations of the pipe manufacturer.

3.1.5.7 Galvanized-Steel Pipe

Screw joints shall be made tight with a stiff mixture of graphite and oil, inert filler and oil, or with an approved graphite compound, applied with a brush to the male threads only. Compounds shall not contain lead.

3.1.5.8 Copper Tubing

Joints shall be made with flared fittings. The flared end tube shall be pulled tightly against the tapered part of the fitting by a nut which is part of the fitting, so there is metal-to-metal contact.

3.1.5.9 Bonded Joints

Bonded joints shall be installed in accordance with details specified for joints in paragraph JOINTS.

3.1.5.10 Isolation Joints and Dielectric Fittings

Isolation joints and dielectric fittings shall be installed in accordance with details specified in paragraph JOINTS. Dielectric unions shall be encapsulated in a field-poured coal-tar covering, with at least 3 mm (1/8 inch) thickness of coal tar over all fitting surfaces.

3.1.5.11 Connections

Connections between different types of pipe and accessories shall be made with transition fittings approved by the Contracting Officer.

3.1.6 Service Lines

Service lines shall include the pipeline connecting building piping to water distribution lines to the connections with the building service at a point approximately 5 feet outside the building where such building service exists. Where building services are not installed, the Contractor shall terminate the service lines approximately (5 feet) from the site of the proposed building at a point designated by the Contracting Officer. Such service lines shall be closed with plugs or caps. All service stops and valves shall be provided with service boxes. Service lines shall be constructed in accordance with the following requirements:

3.1.6.1 Service Lines

Service lines 2 inches and smaller shall be connected to the main by a directly-tapped corporation stop or by a service clamp. A corporation stop and a copper gooseneck shall be provided with either type of connection. Maximum sizes for directly-tapped corporation stops and for outlets with service clamps shall be as in TABLE I. Where 2 or more gooseneck connections to the main are required for an individual service, such connections shall be made with standard branch connections. The total clear area of the branches shall be at least equal to the clear area of the service which they are to supply.

TABLE I. SIZE OF CORPORATION STOPS AND OUTLET

Corporation Stops, mm (Inches)		Outlets w/Service
Pipe Size	For Ductile-Iron Pipe	Clamps, mm (Inches)
mm (Inches)		Single & Double Strap
80 (3)	--	25 (1)
100 (4)	25 (1)	25 (1)
150 (6)	32 (1-1/4)	40 (1-1/2)
200 (8)	40 (1-1/2)	50 (2)
250 (10)	40 (1-1/2)	50 (2)
300 (12) & larger (50 (2)	50 (2)

3.1.6.2 Service Lines for Sprinkler Supplies

Water service lines used to supply building sprinkler systems for fire protection shall be connected to the water distribution main in accordance with NFPA 24.

3.1.7 Field Coating and Lining of Pipe

3.1.7.1 Steel Pipe Not Galvanized

a. Cement-mortar coating and lining: Field jointing shall conform to Appendix, AWWA C205. Any defective area found in the coating and/or lining of pipe and joints shall be removed to the pipe wall and repaired. The repaired areas shall be at least equal in thickness to the minimum coating and/or lining required for the pipe. Steel reinforcement in the coating shall be repaired or replaced as necessary to assure a complete and soundly reinforced coating.

b. Coal-tar enamel coating, lining and wrapping: Field jointing shall conform to AWWA C203. The applied materials shall be tested by means of a spark-type electrical inspection device in accordance with the requirements of AWWA C203. Any flaws or holidays found in the coating and/or lining of pipe and joints shall be repaired by patching or other approved means. The repaired areas shall be at least equal in thickness to the minimum coating and/or lining required for the pipe.

3.1.7.2 Galvanized-Steel Pipe

Field joints shall be given one coat of coal-tar primer and two coats of coal-tar enamel conforming to AWWA C203. The tests of the coating shall conform to AWWA C203, and any flaws or holidays found in the coating of pipe and joints shall be repaired by patching or other approved means such that the repaired areas will be at least equal in thickness to the minimum coating required for the pipe.

33.1.8 Setting of Fire Hydrants, Meters, Valves and Valve Boxes

3.1.8.1 Fire Hydrants

Fire hydrants shall be located and installed as shown. Each hydrant shall be connected to the main with a 6 inch branch line having at least as much cover as the distribution main. Hydrants shall be set plumb with pumper nozzle facing the roadway, with the center of the lowest outlet not less than 18 inches above the finished surrounding grade, and the operating nut not more than 48 inches above the finished surrounding grade. Fire hydrants designated on the drawings as low profile shall have the lowest outlet not less than 18 inches above the finished surrounding grade, the top of the hydrant not more than 24 inches above the finished surrounding grade. Except where approved otherwise, the backfill around hydrants shall be thoroughly compacted to the finished gradeline immediately after installation to obtain beneficial use of the hydrant as soon as practicable. The hydrant shall be set upon a slab of concrete not less than 4 inches thick and 15 inches square. Not less than 7 cubic feet of free-draining broken stone or gravel shall be placed around and beneath the waste opening of dry barrel hydrants to ensure drainage.

3.1.8.2 Valves

After delivery, valves, including those in hydrants, shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and hydrants and valves shall be fully opened and fully closed to ensure that all parts are in working condition. Check, pressure reducing, vacuum, and air relief valves shall be installed in valve pits. Valves and valve boxes shall be installed where shown or specified, and shall be set plumb. Valve boxes

shall be centered on the valves. Boxes shall be installed over each outside gate valve unless otherwise shown. Where feasible, valves shall be located outside the area of roads and streets. Earth fill shall be carefully tamped around each valve box or pit to a distance of 4 feet on all sides of the box, or the undisturbed trench face if less than 4 feet.

3.1.8.3 Service Boxes

Where water lines are located below paved streets having curbs, the boxes shall be installed directly back of the curbs. Where no curbing exists, service boxes shall be installed in accessible locations, beyond the limits of street surfacing, walks and driveways.

3.1.9 Tapped Tees and Crosses

Tapped tees and crosses for future connections shall be installed where shown.

3.1.10 Thrust Restraint

Plugs, caps, tees and bends deflecting 11-1/4 degrees or more, either vertically or horizontally, on waterlines 4 inches in diameter or larger, and fire hydrants shall be provided with thrust restraints. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be either thrust blocks or, for ductile-iron pipes, restrained joints.

3.1.10.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2,000 psi after 28 days. Blocking shall be placed between solid ground and the hydrant or fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.10.2 Restrained Joints

For ductile-iron pipe, restrained joints shall be designed by the Contractor or the pipe manufacturer in accordance with DIPRA-01.

3.2 HYDROSTATIC TESTS

Where any section of a water line is provided with concrete thrust blocking for fitting or hydrants, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking, unless otherwise approved.

3.2.1 Pressure Test

After the pipe is laid, the joints completed, fire hydrants permanently

installed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 200 psi. Water supply lines designated on the drawings shall be subjected for 1 hour to a hydrostatic pressure test of 200psi. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, hydrants, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, hydrants and valves, discovered in consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are satisfactory. The requirement for the joints to remain exposed for the hydrostatic tests may be waived by the Contracting Officer when one or more of the following conditions is encountered:

- a. Wet or unstable soil conditions in the trench.
- b. Compliance would require maintaining barricades and walkways around and across an open trench in a heavily used area that would require continuous surveillance to assure safe conditions.
- c. Maintaining the trench in an open condition would delay completion of the contract.

The Contractor may request a waiver, setting forth in writing the reasons for the request and stating the alternative procedure proposed to comply with the required hydrostatic tests. Backfill placed prior to the tests shall be placed in accordance with the requirements of Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.2.2 Leakage Test

Leakage test shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the water line shall be subjected to not less than 200 psi pressure. Water supply lines designated on the drawings shall be subjected to a pressure equal to 200 psi. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain pressure within 5 psi of the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted if leakage exceeds the allowable leakage which is determined by the following formula:

$L = 0.0001351ND(P \text{ raised to } 1/2 \text{ power})$

L = Allowable leakage in gallons per hour

N = Number of joints in the length of pipeline tested

D = Nominal diameter of the pipe in inches

P = Average test pressure during the leakage test, in psi gauge

Should any test of pipe disclose leakage greater than that calculated by the above formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the Government.

3.2.3 Time for Making Test

Except for joint material setting or where concrete thrust blocks necessitate a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill. Cement-mortar lined pipe may be filled with water as recommended by the manufacturer before being subjected to the pressure

test and subsequent leakage test.

3.2.4 Concurrent Hydrostatic Tests

The Contractor may elect to conduct the hydrostatic tests using either or both of the following procedures. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be satisfactory as specified. All replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Government.

- a. Pressure test and leakage test may be conducted concurrently.
- b. Hydrostatic tests and disinfection may be conducted concurrently, using the water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be reaccomplished.

3.3 DISINFECTION(NOT USED)

3.3.1 Bacteriological Disinfection

Before acceptance of potable water operation, each unit of completed waterline shall be disinfected as prescribed by AWWA C651.as specified herein. After pressure tests have been made, the unit to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material. The chlorinating material shall be either liquid chlorine, calcium hypochlorite, or sodium hypochlorite, conforming to paragraph MISCELLANEOUS ITEMS. The chlorinating material shall provide a dosage of not less than 50 ppm and shall be introduced into the water lines in an approved manner. Polyvinyl Chloride (PVC) pipe lines shall be chlorinated using only the above specified chlorinating material in solution. In no case will the agent be introduced into the line in a dry solid state. The treated water shall be retained in the pipe long enough to destroy all non-spore-forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 25 ppm of free chlorine residual throughout the line at the end of the retention period. All valves on the lines being disinfected shall be opened and closed several times during the contact period. The line shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 ppm. From several points in the unit, the Contracting Officer will take samples of water in proper sterilized containers for bacterial examination. personnel from the Contractor's commercial laboratory shall take at least 3 water samples from different points, approved by the Contracting Officer, in proper sterilized containers and perform a bacterial examination in accordance with state approved methods. The commercial laboratory must be certified by the state's approving authority for examination of potable water.] The disinfection shall be repeated until tests indicate the absence of pollution for at least 2 full days. The unit will not be accepted until satisfactory bacteriological results have been obtained.

3.3.2 Lead Residual

Following the bacteriological disinfection and testing, the system shall be furnished with a sufficient velocity of water and sufficient tests performed at each hot- and cold-water discharge point until no less than 15 ppb lead residuals remain in the system. All tests and samples shall be

performed in accordance with state and, if applicable, Federal regulations. Samples for testing are to be collected after a 6-hour continuous period of no flushing, and will be considered first draw samples. The commercial laboratory must be certified by the state's approving authority for examination of potable water. Lead residual test results are to be submitted to the Contracting Officer. The system will not be accepted until satisfactory bacteriological results and lead residual test results have been obtained. All flushing and testing for lead residuals, including all costs, are the responsibility of the Contractor.

3.4 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --

SECTION 02711

FOUNDATION DRAINAGE SYSTEM
07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION
OFFICIALS (AASHTO)

AASHTO M 252	(1994) Corrugated Polyethylene Drainage Tubing
AASHTO M 294	(1994) Corrugated Polyethylene Pipe, 12- to 36 in. Diameter

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 74	(1994) Cast Iron Soil Pipe and Fittings
ASTM A 760	(1995a) Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
ASTM B 745	(1993) Corrugated Aluminum Pipe for Sewers and Drains
ASTM C 4	(1995) Clay Drain Tile
ASTM C 14	(1995) Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 33	(1993) Concrete Aggregates
ASTM C 412	(1994) Concrete Drain Tile
ASTM C 425	(1995) Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C 444	(1994) Perforated Concrete Pipe
ASTM C 498	(1995) Perforated Clay Drain Tile
ASTM C 508	(1990; R 1994) Asbestos-Cement Underdrain Pipe
ASTM C 654	(1995) Porous Concrete Pipe

ASTM C 700	(1995) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM D 2751	(1993) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 3034	(1994) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1992) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F 405	(1993) Corrugated Polyethylene (PE) Tubing and Fittings
ASTM F 667	(1985) Large Diameter Corrugated Polyethylene Tubing and Fittings
ASTM F 758	(1993) Smooth-Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage
ASTM F 949	(1993) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-13 Certificates

Materials; FIO

Certifications from the manufacturers attesting that materials meet specification requirements.

1.3 DELIVERY, STORAGE AND HANDLING

Materials placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Plastic pipe shall not be exposed to direct sunlight for more than 6 months from time of manufacturer to installation.

PART 2 PRODUCTS

2.1 MATERIALS

Pipe for foundation drainage system shall be of the type and size indicated. Appropriate transitions, adapters, or joint details must be used where pipes of different types or materials are connected.

2.1.1 Plastic Pipe

Plastic pipe shall contain ultraviolet inhibitor to provide protection from exposure to direct sunlight.

2.1.1.1 Corrugated Polyethylene (PE) Drainage Pipe

Use ASTM F 405 heavy duty for pipe 3 to 6 inches in diameter inclusive, ASTM F 667 for pipe 8 to 24 inches in diameter; or use AASHTO M 252 for pipe 3 to 10 inches in diameter or AASHTO M 294 for pipe 12 to 24 inches in diameter. Fittings shall be pipe manufacturer's standard type and shall conform to the indicated specification.

2.1.1.2 Circular Perforations in Plastic Pipe

Circular holes shall be cleanly cut, not more than 5/16 inch or less than 3/16 inch in diameter, and arranged in rows parallel to the longitudinal axis of the pipe. Perforations shall be approximately 3 inches apart, center-to-center, along rows. The rows shall be approximately 1-1/2 inches apart and arranged in a staggered pattern so that all perforations lie at the midpoint between perforations in adjacent rows. The rows shall be spaced over not more than 155 degrees of circumference. The spigot or tongue end of the pipe shall not be perforated for a length equal to the depth of the socket and perforations shall continue at uniform spacing over the entire length of the pipe. Manufacturer's standard perforated pipe which essentially meets these requirements may be used with prior approval of the Contracting Officer.

2.2 Fittings

Fittings shall be of compatible materials for pipe, of corresponding weight and quality, and as specified herein.

2.3 Cleanouts and Piping Through Walls

Cleanout pipe and fittings and piping through walls and footings shall be cast-iron soil pipe. Each cleanout shall have a brass ferrule and a cast-brass screw-jointed plug with socket or raised head for wrench.

2.4 Sand Filter Material

Shall be as specified in SECTION 02221 excavation, Filling, and Backfilling for buildings.

2.5 Gravel Filter Material for Foundation Drains

Shall be the same as capillary water barrier in accordance with Section 02221 EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS.

2.6 Protective Covering for Pervious Backfill

Protective covering shall be building paper or fiberglass mat of lime borosilicate glass fibers. Fibers shall be 8 to 12 microns in average diameter, 2 to 4 inches in length, and bonded with phenol formaldehyde resin. Mat shall be roll type, nonperforated, water permeable, with thickness between 1/4 and 1/2 inch and density of 3/4 pcf.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

3.1.1 Extent

Foundation drainage shall be furnished and installed as a complete system .

3.1.2 Outlet Connections

Foundation pipe shall be terminated as shown.

3.1.3 Drainage Lines

Drainage lines shall be constructed of drain tile, perforated pipe, or porous pipe.

3.1.4 Outlet Lines

Outlet lines shall be constructed of closed-joint nonperforated, nonporous pipe.

3.2 INSTALLATION

3.2.1 Trenching and Excavation

Required trenching and excavation shall be in accordance with Section 02221 EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS, Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Trenches shall be kept dry during installation of drainage system. Changes in direction of drain lines shall be made with 1/8 bends. Wye fittings shall be used at intersections.

3.2.2 Bedding

Graded bedding, minimum 6 inches in depth, shall be placed in the bottom of trench for its full width and length and compacted as specified prior to laying of foundation drain pipe. Each section shall rest firmly upon the bedding, through the entire length, with recesses formed for bell joints. Except for recesses for bell joints, the bedding shall fully support the lower quadrant of the pipe.

3.2.3 Pipe Laying

Drain lines shall be laid to true grades and alignment with a continuous fall in the direction of flow. Bells of pipe sections shall face upgrade. Interior of pipe shall be cleaned thoroughly before being laid. When drain lines are left open for connection to discharge lines, the open ends shall be temporarily closed and the location marked with wooden stakes. Perforated pipe shall be laid with perforations facing down. Any length that has had its grade or joints disturbed shall be removed and relaid at no additional cost to the Government. Perforated corrugated polyethylene drainage tubing and plastic piping shall be installed in accordance with manufacturer's specifications and as specified herein. Tubing and piping with physical imperfections shall not be installed.

3.2.4 Jointing

3.2.4.1 Perforated and Porous Pipes

Perforated and porous types of drain pipes shall be laid with closed joints.

3.2.5 Outlet Lines

The outlet end of drain lines connecting with an open gutter or outfall shall be covered with a removable wire basket of 16-mesh copper or bronze wire cloth fastened with brass or wire straps finished as shown.

3.2.6 Backfilling

After joints and connections have been inspected and approved, the specified pervious backfill material shall be placed a minimum width of 6 inches on each side of the pipe or tile for the full width of the trench and full width between pipe and adjacent walls] and 12 inches above the top of the pipe. When placing the backfill, care shall be taken to prevent displacement of or injury to the pipe or tile. A protective covering, as specified, shall be placed over the pervious backfill for the full width of the trench before regular backfill is placed. Backfill shall be compacted as specified in Section 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS Section 02222 EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES SYSTEMS.

-- End of Section --

SECTION 02720

STORM-DRAINAGE SYSTEM

07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 346/346R	(1990) Standard Specification for Cast-in-Place Nonreinforced Concrete Pipe and Recommendations
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AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS	(AASHTO)
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AASHTO HB-16	(1996) Standard Specifications for Highway Bridges
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AASHTO M 167	(1994) Corrugated Steel Structural Plate, Zinc Coated, for Field Bolted Pipe
--------------	--

AASHTO M 190	(1988) Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches
--------------	--

AASHTO M 198	(1994) Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
--------------	--

AASHTO M 219	(1992) Aluminum Alloy Structural Plate for Field Bolted Conduits
--------------	--

AASHTO M 243	(1994) Field Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe-Arches, and Arches
--------------	---

AASHTO M 294	(1994) Corrugated Polyethylene Pipe, 305- to 915- mm 12-to 36 in. Diameter
--------------	--

AASHTO M 304	(1994) Poly(Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter
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AMERICAN RAILWAY ENGINEERING ASSOCIATION (AREA)

AREA-03	(1994) Manual for Railway Engineering (Fixed Properties): Chapter 1, Roadway and Ballast
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48	(1994a) Gray Iron Castings
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 444	(1989) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process for Storm Sewer and Drainage Pipe
ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM A 716	(1995) Ductile Iron Culvert Pipe
ASTM A 742	(1993) Steel Sheet, Metallic Coated and Polymer Precoated for Corrugated Steel Pipe
ASTM A 760	(1995a) Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
ASTM A 762	(1995) Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM A 798	(1994) Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
ASTM A 807	(1996) Installing Corrugated Steel Structural Plate Pipe for Sewers and Other Applications
ASTM A 849	(1994) Post Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe
ASTM B 26	(1996) Aluminum-Alloy Sand Castings
ASTM B 745	(1995) Corrugated Aluminum Pipe for Sewers and Drains
ASTM C 12	(1995) Installing Vitrified Clay Pipe Lines
ASTM C 14	(1995) Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 32	(1993) Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C 55	(1995) Concrete Building Brick
ASTM C 62	(1996) Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 76	(1995) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 139	(1995) Concrete Masonry Units for Construction of Catch Basins and Manholes

ASTM C 231	(1991b) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 270	(1996a) Mortar for Unit Masonry
ASTM C 425	(1995) Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C 443	(1994) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 478	(1994) Precast Reinforced Concrete Manhole Sections
ASTM C 506	(1995) Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
ASTM C 507	(1995a) Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
ASTM C 655	(1994) Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
ASTM C 700	(1996) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM C 789	(1994) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers
ASTM C 850	(1994) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 Ft. of Cover Subjected to Highway Loadings
ASTM C 877	(1994) External Sealing Bands for Noncircular Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM D 1056	(1991) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1171	(1994) Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1992) Preformed Sponge Rubber and

	Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 1784	(1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2321	(1989; R 1995) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2922	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 3034	(1994) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1992) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3350	(1993) Polyethylene Plastics Pipe and Fittings Materials
ASTM F 477	(1995) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 679	(1995) Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F 714	(1994) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F 794	(1995a) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 894	(1995) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ASTM F 949	(1994) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Instructions

Placing Pipe; GA.

Printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

SD-13 Certificates

Resin Certification; GA. Pipeline Testing; GA. Hydrostatic Test on Watertight Joints; GA. Determination of Density; GA. Frame and Cover for Gratings; FIO.

Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed. Certification on the ability of frame and cover or gratings to carry the imposed live load.

SD-14 Samples

Pipe for Culverts and Storm Drains; GA.

Samples of the following materials, before work is started: GA.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Gasket materials and plastic materials shall be protected from exposure to the direct sunlight over extended periods.

1.3.2 Handling

Materials shall be handled in such a manner as to ensure delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Corrugated Steel Pipe

ASTM A 760, aluminum coated pipe of either:

- a. Type II pipe with helical corrugations.
- b. Type IIA pipe with helical corrugations fabricated with a smooth steel liner of Type C precoated sheet with a polymeric coating on both sides of not less than 0.010 inch thick conforming to ASTM A 742.

c. Type IIR pipe with helical corrugations.

2.1.2 Ductile Iron Culvert Pipe

ASTM A 716.

2.1.3 PVC Pipe

The pipe manufacturer's resin certification, indicating the cell classification of PVC used to manufacture the pipe in accordance with AASHTO M 304, shall be submitted prior to installation of the pipe.

2.1.3.1 Type PSM PVC Pipe

ASTM D 3034, Type PSM, maximum SDR 35, produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

2.1.3.2 Profile PVC Pipe

ASTM F 794, Series 46, produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

2.1.3.3 Smooth Wall PVC Pipe

ASTM F 679 produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

2.1.4 DRAINAGE STRUCTURES

2.1.4.1 Precast Reinforced Concrete Box

For highway loadings with 2 feet of cover or more or subjected to dead load only, ASTM C 789; for less than 2 feet of cover subjected to highway loading, ASTM C 850.

2.1.5 MISCELLANEOUS MATERIALS

2.1.5.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for concrete under Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with ASTM C 231. The concrete covering over steel reinforcing shall not be less than 1 inch thick for covers and not less than 1-1/2 inchesthick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inchesbetween steel and ground. Expansion-joint filler material shall conform to ASTM D 1751, or ASTM D 1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D 1752.

2.1.5.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick

or block construction shall conform to ASTM C 270, Type M, except the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar but in no case shall exceed gallons of water per sack of cement. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

2.1.5.3 Precast Reinforced Concrete Manholes

Precast reinforced concrete manholes shall conform to ASTM C 478. Joints between precast concrete risers and tops shall be made with flexible watertight, rubber-type gaskets meeting the requirements of paragraph JOINTS.

2.1.5.4 Prefabricated Corrugated Metal Manholes

Manholes shall be of the type and design recommended by the manufacturer. Manholes shall be complete with frames and cover, or frames and gratings.

2.1.5.5 Joints

2.1.5.5.1 Flexible Watertight Joints

- a. Materials: Flexible watertight joints shall be made with plastic or rubber-type gaskets for concrete pipe and with factory-fabricated resilient materials for clay pipe. The design of joints and the physical requirements for plastic gaskets shall conform to AASHTO M 198, and rubber-type gaskets shall conform to ASTM C 443. Factory-fabricated resilient joint materials shall conform to ASTM C 425. Gaskets shall have not more than one factory-fabricated splice, except that two factory-fabricated splices of the rubber-type gasket are permitted if the nominal diameter of the pipe being gasketed exceeds 54 inches.
- b. Test Requirements: Watertight joints shall be tested and shall meet test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS. Rubber gaskets shall comply with the oil resistant gasket requirements of ASTM C 443. Certified copies of test results shall be delivered to the Contracting Officer before gaskets or jointing materials are installed. Alternate types of watertight joint may be furnished if specifically approved.

2.2 External Sealing Bands

Requirements for external sealing bands shall conform to ASTM C 877.

2.3 Flexible Watertight, Gasketed Joints

- a. Gaskets: When infiltration or exfiltration is a concern for pipe lines, the couplings may be required to have gaskets. The closed-cell expanded rubber gaskets shall be a continuous band approximately 7 inches wide and approximately 3/8 inch thick, meeting the requirements of ASTM D 1056, Type 2 A1 and shall have a quality retention rating of not less than 70 percent when tested

for weather resistance by ozone chamber exposure, Method B of ASTM D 1171. Rubber O-ring gaskets shall be 13/16 inch in diameter for pipe diameters of 36 inches or smaller and 7/8 inch in diameter for larger pipe having 1/2 inch deep end corrugation. Rubber O-ring gaskets shall be 1-3/8 inches in diameter for pipe having 1 inch deep end corrugations. O-rings shall meet the requirements of AASHTO M 198 or ASTM C 443. Flexible plastic gaskets shall conform to requirements of AASHTO M 198, Type B.

- b. Connecting Bands: Connecting bands shall be of the type, size and sheet thickness of band, and the size of angles, bolts, rods and lugs as indicated or where not indicated as specified in the applicable standards or specifications for the pipe. Exterior rivet heads in the longitudinal seam under the connecting band shall be countersunk or the rivets shall be omitted and the seam welded. Watertight joints shall be tested and shall meet the test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS.

2.4 PVC Plastic Pipes

Joints shall be solvent cement or elastomeric gasket type in accordance with the specification for the pipe and as recommended by the pipe manufacturer.

2.5 DOWNSPOUT BOOTS

Boots used to connect exterior downspouts to the storm-drainage system shall be of gray cast iron conforming to ASTM A 48, Class 30B or 35B. Shape and size shall be as indicated.

2.6 HYDROSTATIC TEST ON WATERTIGHT JOINTS

2.6.1 Concrete, Clay, PVC and PE Pipe

A hydrostatic test shall be made on the watertight joint types as proposed. Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample joint may be tested. During the test period, gaskets or other jointing material shall be protected from extreme temperatures which might adversely affect the performance of such materials. Test requirements for joints in PVC and PE plastic pipe shall conform to ASTM D 3212.

2.6.2 Corrugated Steel and Aluminum Pipe

A hydrostatic test shall be made on the watertight joint system or coupling band type proposed. The moment strength required of the joint is expressed as 15 percent of the calculated moment capacity of the pipe on a transverse section remote from the joint by the AASHTO HB-16 (Division II, Section 26). The pipe will be supported for the hydrostatic test so that the joint is located at the point which develops 15 percent of the moment capacity of the pipe based on the allowable span in feet for the pipe flowing full or 40,000 foot-pounds, whichever is less. Performance requirements shall be met at an internal hydrostatic pressure of 10 psi for a 10 minute period for both annular corrugated metal pipe and helical corrugated metal pipe with factory reformed ends.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches and for appurtenances and backfilling for culverts and storm drains shall be in accordance with the applicable portions of Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS and Section 02225 EARTHWORK FOR ROADWAYS, RAILROADS, AND AIRFIELDS and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus 24 inches to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheet piling and bracing where required shall be placed within the trench width as specified. Care shall be taken not to overexcavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures shall be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor in his performance of shoring and sheet piling, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Corrugated Metal Pipe

Bedding for corrugated metal pipe and pipe arch shall be in accordance with ASTM A 798. It is not required to shape the bedding to the pipe geometry. However, for pipe arches, it is recommended to either shape the bedding to the relatively flat bottom arc or fine grade the foundation to a shallow v-shape.

3.2.2 Ductile Iron Pipe

Bedding for ductile iron pipe shall be as shown on the drawings.

3.2.3 Plastic Pipe

Bedding for PVC and PE pipe shall meet the requirements of ASTM D 2321. Bedding, haunching, and initial backfill shall be either Class IB or II material.

3.3 PLACING PIPE

Each pipe shall be carefully examined before being laid, and defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to the direct sunlight prior to laying as needed to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary.

3.3.1 Corrugated Metal Pipe and Pipe Arch

Laying shall be with the separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream, and with longitudinal laps on the sides. Any unprotected metal in the joints shall be coated with bituminous material specified in AASHTO M 190 or AASHTO M 243. Interior coating shall be protected against damage from insertion or removal of struts or tie wires. Lifting lugs shall be used to facilitate moving pipe without damage to exterior or interior coatings. During installation, pipe or pipe arch shall be handled with care to preclude damage to the bituminous coating or paving. Prior to placing backfill, damaged areas of coupling bands and pipe shall be given a coating of bituminous material, specified in AASHTO M 190 or AASHTO M 243. Pipe on which bituminous coating has been damaged to such an extent that satisfactory field repairs cannot be made shall be removed and replaced. Vertical elongation, where indicated, shall be accomplished by factory elongation. Suitable markings or properly placed lifting lugs shall be provided to ensure placement of factory elongated pipe in a vertical plane.

3.4 JOINTS

3.4.1 Corrugated Metal Pipe

3.4.1.1 Field Joints

Transverse field joints shall be of such design that the successive connection of pipe sections will form a continuous line free of appreciable irregularities in the flow line. In addition, the joints shall meet the general performance requirements described in ASTM A 798. Suitable transverse field joints which satisfy the requirements for one or more of the joint performance categories can be obtained with the following types of connecting bands furnished with suitable band-end fastening devices: corrugated bands, bands with projections, flat bands, and bands of special design that engage factory reformed ends of corrugated pipe. The space between the pipe and connecting bands shall be kept free from dirt and grit so that corrugations fit snugly. The connecting band, while being tightened, shall be tapped with a soft-head mallet of wood, rubber or plastic, to take up slack and ensure a tight joint. The annular space between abutting sections of part paved, and fully paved pipe and pipe arch, in sizes 30 inches or larger, shall be filled with a bituminous material after jointing. Field joints for each type of corrugated metal pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installations. The type, size, and sheet thickness of the band and the size of angles or lugs and bolts shall be as indicated or where not indicated, shall be as

specified in the applicable standards or specifications for the pipe.

3.4.1.2 Flexible Watertight, Gasketed Joints

Installation shall be as recommended by the gasket manufacturer for use of lubricants and cements and other special installation requirements. The gasket shall be placed over one end of a section of pipe for half the width of the gasket. The other half shall be doubled over the end of the same pipe. When the adjoining section of pipe is in place, the doubled-over half of the gasket shall then be rolled over the adjoining section. Any unevenness in overlap shall be corrected so that the gasket covers the end of pipe sections equally. Connecting bands shall then be centered over adjoining sections of pipe, and rods or bolts placed in position and nuts tightened. Band Tightening: The band shall be tightened evenly, even tension being kept on the rods or bolts, and the gasket shall be closely observed to see that it is seating properly in the corrugations. Watertight joints shall remain uncovered for a period of time designated, and before being covered, tightness of the nuts shall be measured with a torque wrench. If the nut has tended to loosen its grip on the bolts or rods, the nut shall be retightened with a torque wrench and remain uncovered until a tight, permanent joint is assured.

3.5 DRAINAGE STRUCTURES

3.5.1 Walls and Headwalls

Headwalls shall be reinforced concrete as shown on the plans.

Construction shall be as indicated.

3.6 STEEL LADDER INSTALLATION

Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 6 feet vertically, and shall be so installed as to provide at least 6 inches of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.

3.7 BACKFILLING

3.7.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 12 inches above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding inches. Tests for density will be made as necessary to ensure conformance to the compaction requirements specified elsewhere in this paragraph. Where it is necessary in the opinion of the Contracting Officer, any sheeting or portions of bracing used shall be left in place and the contract will be adjusted accordingly. Untreated sheeting

shall not be left in place beneath structures or pavements.

3.7.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified elsewhere in this paragraph. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding

3.7.3 Movement of Construction Machinery

In compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.7.4 Compaction

3.7.4.1 General

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.7.4.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density (densities) which will be determined as specified in this paragraph.

- a. Under airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.
- b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.
- c. Under nontraffic areas, density shall be not less than that of the surrounding material.

3.7.5 Determination of Density

Testing shall be the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D 1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D 2167 or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017 or ASTM D 2922. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

3.8 PIPELINE TESTING

Lines shall be tested for leakage by exfiltration tests. Prior to testing for leakage the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. An exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be reestablished. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by the exfiltration test shall not exceed 0.2 gallons per inch in diameter per 100 feet of pipeline per hour. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correcting, and retesting shall be made at no additional cost to the Government.

-- End of Section --

SECTION 02721

SUBBASE COURSES

07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION
OFFICIALS (AASHTO)

AASHTO T 180 (1993) Moisture-Density Relations of Soils
Using a 4.54-kg (10-lb) Rammer and an
457-mm (18-in) Drop

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29 (1991a) Unit Weight and Voids in Aggregate

ASTM C 117 (1995) Materials Finer Than 75 micrometer
(No. 200) Sieve in Mineral Aggregates by
Washing

ASTM C 131 (1996) Resistance to Degradation of
Small-Size Coarse Aggregate by Abrasion and
Impact in the Los Angeles Machine

ASTM C 136 (1995a) Sieve Analysis of Fine and Coarse
Aggregates

ASTM D 75 (1987; R 1992) Sampling Aggregates

ASTM D 422 (1963; R 1990) Particle-Size Analysis of
Soils

ASTM D 1556 (1990) Density and Unit Weight of Soil in
Place by the Sand-Cone Method

ASTM D 1557 (1991) Laboratory Compaction
Characteristics of Soil Using Modified
Effort (56,000 ft-lbf/cu. ft. (2,700
kN-m/cu.m.))

ASTM D 2167 (1994) Density and Unit Weight of Soil in
Place by the Rubber Balloon Method

ASTM D 2487 (1993) Classification of Soils for
Engineering Purposes (Unified Soil
Classification System)

ASTM D 2922	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E 11	(1995) Wire-Cloth Sieves for Testing Purposes

1.2 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 AASHTO T 180, Method D. In this specification, degree of compaction shall be a percentage of laboratory maximum density.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment; FIO.

List of proposed equipment to be used in performance of construction work, including descriptive data.

SD-09 Reports

Sampling and Testing; GA..
Copies of initial and in-place test results.

SD-18 Records

Waybills and Delivery Tickets; FIO.

Copies of waybills and delivery tickets during the progress of the work.
Certified waybills and delivery tickets for all aggregates actually used.

1.4 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved testing laboratory in accordance with Section 01440 CONTRACTOR QUALITY CONTROL. Tests shall be performed at the specified frequency. No work requiring testing will be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements.

1.4.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.4.2 Tests

1.4.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with ASTM D 422. Sieves shall conform to ASTM E 11.

1.4.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

1.4.2.3 Moisture-Density Determinations

The maximum density and optimum moisture shall be determined in accordance with ASTM D 1557.

1.4.2.4 Density Tests

Density shall be field measured in accordance with ASTM D 1556. The base plate, as shown in the drawing shall be used. ASTM D 2167. ASTM D 2922. The calibration curves shall be checked and adjusted, if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and, when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration, in ASTM D 2922, on each different type of material to be tested at the beginning of a job and at intervals as directed.

1.4.2.5 Wear Test

Wear tests shall be made on subbase course material in conformance with ASTM C 131.

1.4.2.6 Weight of Slag

Weight per cubic meter foot of slag shall be determined in accordance with ASTM C 29 on the subbase course material.

1.4.3 Testing Frequency

1.4.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements prior to installation.

- a. Sieve Analysis including 0.02 mm size material
- b. Liquid limit and plasticity index moisture-density relationship
- c. Wear

- d. Weight per cubic meter (foot) of Slag

1.4.3.2 In-Place Tests

One of each of the following tests shall be performed on samples taken from the placed and compacted subbase course. Samples shall be taken for each (1000)square meters yards of each layer of material placed in each area.

- a. Sieve Analysis including 0.02 mm size material
- b. Field Density
- c. Moisture liquid limit and plasticity index

1.4.4 Approval of Material

The source of the material shall be selected 45 days prior to the time the material will be required in the work. Approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted subbase course.

1.5 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 2 degrees C. (35 degrees F). When the temperature falls below 2 degrees C, (35 degrees F,) the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.6 EQUIPMENT

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Select-Material Subbase Course

Materials shall consist of selected soil or other materials from field excavation, stockpiles, or other sources. Material shall be free from lumps and balls of clay and from organic and other objectionable matter. Not more than 25 percent by weight shall pass the 0.075 mm (No. 200)sieve. The portion of material passing the 0.425 mm (No. 40) sieve shall have a liquid limit less than 35 and a plasticity index less than 12. The maximum particle size shall not exceed 75 mm. (3 inches).Particles having diameters less than 0.02 millimeter shall not be in excess of 3 percent by weight of the total sample tested as determined in accordance with ASTM D 422

PART 3 EXECUTION

3.1 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer so as to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.2 PREPARATION OF UNDERLYING MATERIAL

Prior to constructing the select-material subbase course, the underlying course or subgrade shall be cleaned of all foreign substances. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. Ruts, or soft yielding spots, in the underlying courses, subgrade areas having inadequate compaction, and deviations of the surface from the specified requirements, shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses or subgrades containing sands or gravels, as defined in ASTM D 2487, the surface shall be stabilized prior to placement of the subbase course. Stabilization shall be accomplished by mixing subbase-course material into the underlying course, and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements for the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the subbase course is placed.

3.3 GRADE CONTROL

The finished and completed subbase course shall conform to the lines, grades, and cross sections shown. The lines, grades, and cross sections shown shall be maintained by means of line and grade stakes placed by the Contractor at the work site.

3.4 MIXING AND PLACING MATERIALS

The materials shall be mixed and placed to obtain uniformity of the select-material subbase material at the water content specified. The Contractor shall make such adjustments in mixing or placing procedures or in equipment as may be directed to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to insure a satisfactory subbase course.

3.5 LAYER THICKNESS

The compacted thickness of the completed course shall be as indicated. When a compacted layer of 150 mm (6 inches) is specified, the material may be placed in a single layer; when a compacted thickness of more than 150 mm (6 inches) is required, no layer shall exceed 150 mm (6 inches) nor be less than 75 mm (3 inches) when compacted.

3.6 COMPACTION

Each layer of the select-material subbase shall be compacted as specified with approved compaction equipment. Water content shall be maintained

during the compaction procedure to within plus or minus 3 percent of optimum water content, as determined from laboratory tests, as specified in paragraph SAMPLING AND TESTING. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer is compacted through the full depth to at least 95 percent of laboratory maximum density. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory subbase course. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

3.7 EDGES

Approved material shall be placed along the edges of the select-material subbase course in such quantity as will compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, at least a 300 mm (1 foot) width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the subbase course, as directed.

3.8 SMOOTHNESS TEST

The surface of each layer shall not show deviations in excess of 10 mm (3/8 inch) when tested with a 3.6 m (12 foot) 12 foot straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding this amount shall be corrected by removing material, replacing with new material, or reworking existing material and compacting, as directed.

3.9 THICKNESS CONTROL

The completed thickness of the select-material subbase course shall be in accordance with the thickness and grade indicated on the drawings. The thickness of each course shall be measured at intervals providing at least one measurement for each 400 square meters (500 square yards) or part thereof of subbase course. The thickness measurement shall be made by test holes, at least 75 mm (3 inches) in diameter through the course. The completed subbase course shall not be more than 13 mm (1/2 inch) deficient in thickness nor more than 13 mm (1/2 inch) above or below the established grade. Where any of these tolerances are exceeded, the Contractor shall correct such areas by scarifying, adding new material of proper gradation or removing material, and compacting, as directed. Where the measured thickness is 13 mm (1/2 inch) or more thicker than shown, the course will be considered as conforming with the specified thickness requirements plus 13 mm. (1/2 inch). The average job thickness shall be the average of the job measurements as specified above but within 6 mm (1/4 inch) of the thickness shown.

3.10 MAINTENANCE

The select-material subbase course shall be maintained in a satisfactory condition until accepted.

-- End of Section --

SECTION 02722

AGGREGATE BASE COURSE
07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29	(1991a) Unit Weight and Voids in Aggregate
ASTM C 127	(1988; R 1993) Specific Gravity and Absorption of Course Aggregate
ASTM C 128	(1993) Specific Gravity and Absorption of Fine Aggregate
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(1987; R 1992) Sampling Aggregates
ASTM D 422	(1963; R 1990) Particle-Size Analysis of Soils
ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2922	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 DEFINITIONS

1.2.1 Aggregate Base

Aggregate base as used herein is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated hereinafter as percent laboratory maximum density.

1.3 GENERAL

The work specified herein consists of the construction of an aggregate base course. The work shall be performed in accordance with this specification and shall conform to the lines, grades, notes and typical sections shown in the plans. Sources of all materials shall be selected well in advance of the time that materials will be required in the work.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Plant, Equipment, Machines, and Tools; FIO

List of proposed equipment to be used in performance of construction work including descriptive data.

SD-09 Reports

Sampling and Testing; GA

Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results within GA hours after the tests are performed. Certified copies of test results for approval not less than GA days before material is required for the work.

SD-18 Records

Waybills and Delivery Tickets; FIO

Copies of waybills and delivery tickets during the progress of the work. Certified waybills and delivery tickets for all materials actually used. A notification stating which type of coarse aggregate is to be used.

1.5 WEATHER LIMITATIONS

Base shall not be constructed when the atmospheric temperature is less than 35 degrees F. Base shall not be constructed on subgrades that are frozen or contain frost. If the temperature falls below 35 degrees F, completed areas shall be protected against any detrimental effects of freezing.

1.6 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.6.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in satisfactory working condition at all times. Other compacting equipment may be used in lieu of that specified, where it can be demonstrated that the results are equivalent. The equipment shall be adequate and have the capability of producing the results specified.

1.6.2 Steel-Wheeled Rollers

Steel-wheeled rollers shall be the self-propelled type weighing not less than 10 tons, with a minimum weight of 300 pounds per inch width of rear wheel. Wheels of the rollers shall be equipped with adjustable scrapers. The use of vibratory rollers is optional.

1.6.3 Pneumatic-Tired Rollers

Pneumatic-tired rollers shall have four or more tires, each loaded to a minimum of 30,000 pounds and inflated to a minimum pressure of 150 psi. The loading shall be equally distributed to all wheels, and the tires shall be uniformly inflated. Towing equipment shall also be pneumatic-tired.

1.6.4 Mechanical Spreader

Mechanical spreader shall be self-propelled or attached to a propelling unit capable of moving the spreader and material truck. The device shall be steerable and shall have variable speeds forward and reverse. The spreader and propelling unit shall be carried on tracks, rubber tires, or drum-type steel rollers that will not disturb the underlying material. The spreader shall contain a hopper, an adjustable screed, and outboard bumper rolls and be designed to have a uniform, steady flow of material from the hopper. The spreader shall be capable of laying material without segregation across the full width of the lane to a uniform thickness and to a uniform loose density so that when compacted, the layer or layers shall conform to thickness and grade requirements indicated. The Contracting Officer may require a demonstration of the spreader prior to approving use in performance of the work.

1.6.5 Sprinkling Equipment

Sprinkling equipment shall consist of tank trucks, pressure distributors, or other approved equipment designed to apply controlled quantities of water uniformly over variable widths of surface.

1.6.6 Tampers

Tampers shall be of an approved mechanical type, operated by either pneumatic pressure or internal combustion, and shall have sufficient weight and striking power to produce the compaction required.

1.6.7 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one 12 foot straightedge for each bituminous paver, for use in the testing of the finished surface. Straightedge shall be made available for Government use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to ensure rigidity and accuracy. Straightedges shall have handles to facilitate movement on pavement.

1.7 STOCKPILING MATERIALS

Materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at locations designated. Before stockpiling of material, storage sites shall be cleared, and sloped to drain. Materials obtained from different sources shall be stockpiled separately.

1.8 SAMPLING AND TESTING

1.8.1 General Requirements

Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. No work requiring testing shall be permitted until the facilities have been inspected and approved. The first inspection will be at the expense of the Government. Cost incurred for any subsequent inspection required because of failure of the facilities to pass the first inspection will be charged to the Contractor. Tests shall be performed in sufficient numbers and at the locations and times directed to ensure that materials and compaction meet specified requirements. Copies of test results shall be furnished to the Contracting Officer within 24 hours of completion of tests.

1.8.2 Test Results

Results shall verify that materials comply with this specification. When a material source is changed, the new material shall be tested for compliance. When deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced or modified as directed by the Contracting Officer.

1.8.3 Sampling

Aggregate samples for laboratory tests shall be taken in accordance with ASTM D 75.

1.8.4 Sieve Analysis

Before starting work, at least one sample of material shall be tested in accordance with ASTM C 136 and ASTM D 422 on sieves conforming to ASTM E 11. After the initial test, a minimum of one analysis shall be performed for each 1000 tons of material placed, with a minimum of three analyses for each day's run until the course is completed.

1.8.5 Liquid Limit and Plasticity Index

One liquid limit and plasticity index shall be performed for each sieve analysis. Liquid limit and plasticity index shall be in accordance with ASTM D 4318.

1.8.6 Laboratory Density

Tests shall provide a moisture-density relationship for the aggregate. Tests shall be conducted in accordance with ASTM D 1557.

1.8.7 Weight Per Cubic Foot of Slag

Weight per cubic foot of slag shall be determined in accordance with ASTM C 29.

1.8.8 Wear Tests

Wear tests shall be performed in accordance with ASTM C 131. One test shall be run per 2000 square yards of completed base course. A minimum of one test per aggregate source shall be run.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Base Course

Base Course shall meet the requirements for TYPE I-B material according to SECTION 304 as outlines in New Mexico State Highway and Transportation Department Standard Specifications for Highway and Bridges and Construction, 1994.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the base is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 OPERATION OF AGGREGATE SOURCES

Aggregates shall be obtained from off-site sources.

3.3 PREPARATION OF UNDERLYING COURSE

3.3.1 General Requirements

Before constructing aggregate base course, the previously constructed underlying course shall be cleaned of foreign substances. Surface of underlying course shall meet the specified compaction and surface tolerances. Subgrade shall conform to Subbase course shall conform to

[Section 02721 SUBBASE COURSES. Ruts or soft, yielding spots that may appear in the underlying course, areas having inadequate compaction, and deviations of the surface from requirements specified shall be corrected. For cohesionless underlying materials containing sands, sand gravels, or any other cohesionless material in harmful quantities, the surface shall be mechanically stabilized with aggregate prior to placement of the aggregate course. Stabilization may be accomplished by mixing base course material into the underlying course and compacting by approved methods. Properly compacted material will be considered as part of the underlying course and shall meet all requirements for the underlying course. Finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until base course is placed.

3.3.2 Grade Control

Underlying material shall be excavated to sufficient depth for the required base course thickness so that the finished base course with the subsequent surface course will meet the fixed grade. Finished and completed area shall conform to the lines, grades, cross section, and dimensions indicated.

3.4 INSTALLATION

3.4.1 Mixing and Placing

Materials shall be mixed by the stationary plant, traveling plant, or road mix method and placed in such a manner as to obtain uniformity of the aggregate base course material and at a uniform optimum water content for compaction. The Contractor shall make such adjustments in mixing or placing procedures or in equipment to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to ensure a satisfactory base course.

3.4.2 Edges of Base Course

Approved material shall be placed along edges of aggregate base course in such quantities as will compact to thickness of the course being constructed, or to the thickness of each layer in a multiple layer course, allowing in each operation at least a 1 foot width of the shoulder to be rolled and compacted simultaneously with rolling and compacting of each layer of base course.

3.4.3 Compaction

Each layer of aggregate base course including shoulders shall be compacted. Water content shall be maintained at optimum. Density of compacted mixture shall be at least 100 percent of laboratory maximum density. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. Areas inaccessible to the rollers shall be compacted with mechanical tampers, and shall be shaped and finished by hand methods.

3.4.4 Layer Thickness

Compacted thickness of the aggregate course shall be as indicated on plan.

No layer shall be in excess of 8 inches nor less than 3 inches in compacted thickness.

3.4.5 Finishing

The surface of the top layer shall be finished to grade and cross section shown. Finished surface shall be of uniform texture. Light blading during compaction may be necessary for the finished surface to conform to the lines, grades, and cross sections. Should the surface for any reason become rough, corrugated, uneven in texture, or traffic marked prior to completion, such unsatisfactory portion shall be scarified, reworked, recompacted, or replaced as directed.

3.4.5.1 Smoothness

Surface of each layer shall show no deviations in excess of $3/8$ inch when tested with the 12 foot straightedge. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting, as directed.

3.4.5.2 Thickness Control

Compacted thickness of the base course shall be within $1/2$ inch of the thickness indicated. Where the measured thickness is more than $1/2$ inch deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than $1/2$ inch thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within $1/4$ inch of the thickness indicated.

3.5 FIELD QUALITY CONTROL

3.5.1 Field Density

Field in-place density shall be determined in accordance with ASTM D 1556 ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked, and adjusted if necessary, using the sand cone method as described in paragraph Calibration of the ASTM publication. ASTM D 2922 results in a wet unit weight of soil, and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 at least once per lift for each 2000 square yard of base material. Calibration curves and calibration test results shall be furnished within 24 hours of the conclusion of the tests. At least one field density test shall be performed for each square yards of each layer of base material.

3.5.2 Smoothness

Measurements for deviation from grade and cross section shown shall be taken in successive positions parallel to the road centerline with a 12 foot straightedge. Measurements shall also be taken perpendicular to the road centerline at 50 foot intervals.

3.5.3 Thickness

Thickness of the base course shall be measured at intervals in such a manner as to ensure one measurement for each 1000] square of base course. Measurements shall be made in 3 inch diameter test holes penetrating the base course.

3.6 TRAFFIC

Completed portions of the area may be opened to traffic, provided there is no marring or distorting of the surface by the traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.

3.7 MAINTENANCE

The aggregate base course shall be maintained in a satisfactory condition until accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact.

3.8 DISPOSAL OF UNSATISFACTORY MATERIALS

Removed in-place materials that are unsuitable for the base course material that is removed for the required correction of defective areas, and waste material and debris shall be disposed of as directed by the Contracting Office

-- End of Section --

SECTION 02730

SANITARY SEWERS

07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN RAILWAY ENGINEERING ASSOCIATION (AREA)

AREA-03	(1994) Manual for Railway Engineering (Fixed Properties): Chapter 1, Roadway and Ballast
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 74	(1994) Cast Iron Soil Pipe and Fittings
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM C 14	(1995) Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 33	(1993) Concrete Aggregates
ASTM C 76	(1995) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 94	(1995) Ready-Mixed Concrete
ASTM C 150	(1995) Portland Cement
ASTM C 260	(1995) Air-Entraining Admixtures for Concrete
ASTM C 270	(1995a) Mortar for Unit Masonry
ASTM C 425	(1995) Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C 443	(1994) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 478	(1994) Precast Reinforced Concrete Manhole Sections
ASTM C 478M	(1994) Precast Reinforced Concrete Manhole Sections (Metric)

ASTM C 564	(1995) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 700	(1995) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM C 828	(1990) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C 924	(1989) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM C 972	(1982; R 1990) Test Method for Compression-Recovery of Tape Sealant
ASTM D 412	(1992) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 624	(1991) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D 1784	(1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2680	(1995) Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D 2751	(1993) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 2996	(1995) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 2997	(1995) Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced-Thermosetting-Resin) Pipe
ASTM D 3034	(1994) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1992) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3262	(1993) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe
ASTM D 3350	(1993) Polyethylene Plastics Pipe and Fittings Materials
ASTM D 3753	(1981; R 1991) Glass-Fiber-Reinforced Polyester Manholes

ASTM D 3840	(1988) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Nonpressure Applications
ASTM F 402	(1993) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 477	(1993) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 714	(1994) Polyethylene (PE) Plastic pipe (SDR-PR) Based on Outside Diameter
ASTM F 794	(1995a) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 894	(1995) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ASTM F 949	(1993a) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C105	(1988) Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
AWWA C110	(1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(1990) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	(1988) Flanged Ductile-Iron Pipe with Threaded Flanges
AWWA C151	(1991) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 49	(1994) Hazardous Chemicals Data
NFPA 325M	(1991) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
NFPA 704	(1990) Identification of the Fire Hazards of Materials

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-6

(1990) Recommended Practice for the
Low-Pressure Air Testing of Installed Sewer
Pipe

UBPPA UNI-B-9

(1990; Addenda 1994) Recommended
Performance Specification for Polyvinyl
Chloride (PVC) Profile Wall Gravity Sewer
Pipe and Fittings Based on Controlled
Inside Diameter (Nominal Pipe Sizes 4-48
inch)

1.2 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 5 feet outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Excavation and backfilling is specified in Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Backfilling shall be accomplished after inspection by the Contracting Officer. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3 Pipe

The length of pipe installed will be measured from center to center of manholes and from the center of sewer to the end of the service connections without deduction for fittings or diameters of manholes and will be paid for according to the applicable contract unit price per foot for the size of pipe. No extra payment will be made for bends.

1.3.1 Manholes

The depth of manholes will be measured from the top of the cover to the invert of the outlet pipe. Manholes will be paid for according to the applicable contract price each for the depth of manhole indicated in the payment schedule. No extra payment will be made for drop manholes except that the concrete used for encasing the drop connection will be measured and paid for according to the contract unit price per cubic yard of concrete for encasement, and no extra payment will be made for pipe fittings required to make connections to manholes.

1.3.2 Concrete

Concrete used for pipe encasement, cradles, and similar supports, indicated or required for reasons other than faulty construction methods or negligence of the Contractor, will be measured and paid for according to the contract unit price for concrete for encasement and cradles.

1.3.3 Connections to Existing Manholes

Connections to existing manholes will be paid for according to the applicable contract unit price per connection for each required size of pipe, which shall be full compensation for all necessary cutting, shaping, pipe fittings, and concrete, except that concrete required for encasing or cradling pipe outside the manhole will be measured and paid for according to the contract unit price for such concrete.

1.3.4 Wye Branches

Wye branches installed in new sewers will be paid for according to the applicable contract unit price for the size indicated in the payment schedule. This will be in addition to the price per foot of straight pipe.

1.3.5 Connections to Existing Sewers

Connections to existing sewers where new wye branches to cut-ins are required will be paid for according to the contract unit price for such connection. The price will be considered as full compensation for material and labor required for the removal and replacement of the pipe as necessary. Excavation, backfill, and concrete connected with such work will be paid for according to the applicable contract unit prices. Connections of this type made to sewers installed under this contract, if ordered after the sewer has been installed, will be paid for as connection to existing sewers.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-13 Certificates

Portland Cement; FIO

Certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes.

PART 2 PRODUCTS

2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.2 Plastic Pipe

Acrylonitrile-butadiene-styrene (ABS) and polyvinyl chloride (PVC) composite sewer piping shall conform to ASTM D 2680. Size 8 inch through 15 inch diameter.

2.1.2.1 ABS Pipe

ASTM D 2751.

2.1.2.2 PVC Pipe

ASTM D 3034, Type PSM with a maximum SDR of 35, Size 15 inches or less in diameter. ASTM F 949 for corrugated sewer pipes with a smooth interior. UBPPA UNI-B-9 and ASTM F 794, Series 46, for ribbed sewer pipe with smooth interior, size 8 inch through 48 inch diameters. PVC shall be certified by the compounder as meeting the requirements of ASTM D 1784, cell Class 12454B. The pipe stiffness shall be greater than or equal to 735/D for cohesionless material pipe trench backfills.

2.1.2.3 High Density Polyethylene Pipe

ASTM F 894, Class 63, size 18 inch through 120 inch. ASTM F 714, size 4 inch through 48 inch. The polyethylene shall be certified by the resin producer as meeting the requirements of ASTM D 3350, cell Class 334433C. The pipe stiffness shall be greater than or equal to 1170/D for cohesionless material pipe trench backfills.

2.2 FITTINGS

Fittings shall be compatible with the pipe supplied and shall have a strength not less than that of the pipe. Fittings shall conform to the respective specifications and other requirements specified below.

2.2.1 Plastic Pipe

ABS and PVC composite sewer pipe fittings shall conform to ASTM D 2680.

2.2.2 ABS Pipe

ASTM D 2751.

2.2.2.2 PVC Pipe

ASTM D 3034 for type PSM pipe. ASTM F 949 for corrugated sewer pipe with a smooth interior. UBPPA UNI-B-9 and ASTM F 794, Series 46, for ribbed sewer pipe with smooth interior.

2.2.2.3 High Density Polyethylene Pipe

ASTM F 894.

2.3 JOINTS

Joints installation shall comply with the manufacturer's instructions. Fittings and gaskets utilized for waste drains or industrial waste lines shall be certified by the manufacturer as oil resistant.

2.3.1 Concrete Pipe

Joints and gaskets shall conform to ASTM C 443.

2.3.2 Plastic Pipe

Flexible plastic pipe (PVC or high density polyethylene pipe) gasketed joints shall conform to ASTM D 3212.

2.3.2.1 ABS Pipe

ASTM D 2751, solvent weld or bell and spigot O-ring joint, size 12 inches or less in diameter, dimensions and tolerances in accordance with Table 2 therein.

2.3.2.2 High Density Polyethylene Pipe

Rubber gasket joints shall conform to ASTM C 443.

2.4 BRANCH CONNECTIONS

Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS and PVC composite pipe shall conform to Figure 2 of ASTM D 2680; saddles for ABS pipe shall comply with Table 3 of ASTM D 2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

2.5 FRAMES AND COVERS

Frames and covers shall be cast iron, ductile iron or reinforced concrete. Cast iron frames and covers shall be as indicated or shall be of type as suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 400 pounds. Reinforced concrete frames and covers shall be as indicated or shall conform to ASTM C 478 or ASTM C 478M. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.6 CEMENT MORTAR

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.6.1 Portland Cement

Portland cement shall conform to ASTM C 150, Type II for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking.

2.6.2 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psiminimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

2.7 STRUCTURES

2.7.1 Precast Reinforced Concrete Manhole Sections

Precast reinforced concrete manhole sections shall conform to ASTM C 478, except that portland cement shall be as specified herein. Joints shall be cement mortar, an approved mastic, rubber gaskets, a combination of these types; or the use of external preformed rubber joint seals and extruded rolls of rubber with mastic adhesive on one side.

2.7.2 Glass-Fiber Reinforced Polyester Manholes

Glass-fiber-reinforced polyester manholes shall conform to ASTM D 3753.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Adjacent Facilities

3.1.1.1 Water Lines

Where the location of the sewer is not clearly defined by dimensions on the drawings, the sewer shall not be closer horizontally than 10 feet to a water-supply main or service line, except that where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, the horizontal spacing may be a minimum of 6 feet. Where gravity-flow sewers cross above water lines, the sewer pipe for a distance of 10 feet on each side of the crossing shall be fully encased in concrete or shall be acceptable pressure pipe with no joint closer horizontally than 3 feet to the crossing. The thickness of the concrete encasement including that at the pipe joints shall be not less than 4 inches.

3.1.1.2 Roads, Railroads, and Airfields

Water pipe shall be encased in a sleeve of rigid conduit for the lengths shown. Where sleeves are required, the pipe sleeve shall be as specified for storm drains in Section 02720 STORM-DRAINAGE SYSTEM. A minimum clearance of at least 2 inches between the inner wall of the sleeve and the maximum outside diameter of the sleeved pipe and joints shall be provided. Sand bedding shall be provided for the water pipe through the sleeve. Sleeves of ferrous material shall be provided with the corrosion protection as required for the conditions encountered at the site of installation.

3.1.2 Pipe Laying

- a. Pipe shall be protected during handling against impact shocks and free fall and the pipe interior shall be free of extraneous material.
- b. Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and grade shown on the drawings. Pipe shall be laid and centered so that the sewer has a uniform invert. As the work progresses, the interior of the sewer shall be cleared of all superfluous materials.
- c. Before making pipe joints all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints shall then be placed, fitted, joined, and adjusted to obtain the degree of water tightness required.
- d. ABS composite pipe ends with exposed truss and filler material shall be coated with solvent weld material before making the joint

to prevent water or air passage at the joint between the inner and outer wall of the pipe.

- e. Installations of solvent weld joint pipe, using ABS or PVC pipe and fittings shall be in accordance with ASTM F 402. All required precautions shall be taken to assure adequate trench ventilation and protection for workers installing the pipe.

3.1.2.1 Caulked Joints

The packing material shall be well packed into the annular space to prevent the entrance of lead into the pipe. The remainder of the space shall be filled with molten lead that is hot enough to show a rapid change in color when stirred. Scum shall be removed before pouring. The lead shall be caulked to form a tight joint without overstraining the bell and shall have a minimum depth of 1 inch after caulking.

3.1.2.2 Trenches

Trenches shall be kept free of water and as dry as possible during bedding, laying, and jointing and for as long a period as required. When work is not in progress, open ends of pipe and fittings shall be satisfactorily closed so that no trench water or other material will enter the pipe or fittings.

3.1.2.3 Backfill

As soon as possible after the joint is made, sufficient backfill material shall be placed along the pipe to prevent pipe movement off line or grade. Plastic pipe shall be completely covered to prevent damage from ultraviolet light.

3.1.2.4 Width of Trench

If the maximum width of the trench at the top of the pipe, as specified in Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, is exceeded for any reason other than by direction, the Contractor shall install at no additional cost to the Government such concrete cradling, pipe encasement, or other bedding required to support the added load of the backfill.

3.1.2.5 Joints

Joints between different pipe materials shall be made as specified, using approved jointing materials.

3.1.2.6 Handling and Storage

Pipe, fittings and joint material shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities for plastic pipe, fittings, joint materials and solvents shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325M.

3.1.3 Leakage Tests

Lines shall be tested for leakage by low pressure air testing, infiltration

tests or exfiltration tests, as appropriate. Low pressure air testing for vitrified clay pipes shall be as prescribed in ASTM C 828. Low pressure air testing for concrete pipes shall be as prescribed in ASTM C 828. Low pressure air testing for PVC pipe shall be as prescribed in UBPPA UNI-B-6. Low pressure air testing procedures for other pipe materials shall use the pressures and testing times prescribed in ASTM C 828 and ASTM C 924, after consultation with the pipe manufacturer. Prior to infiltration or exfiltration tests the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. When the Contracting Officer determines that infiltration cannot be properly tested, an exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be re-established. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by either the infiltration test or exfiltration test shall not exceed [250 gallons per inch diameter per mile of pipeline per day] [0.2 gallons per inch diameter per 100 feet of pipeline per hour]. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correction, and retesting shall be made at no additional cost to the Government.

3.1.4 Test for Deflection

When flexible pipe is used, a deflection test shall be made on the entire length of the installed pipeline not less than 30 days after the completion of all work including the leakage test, backfill, and placement of any fill, grading, paving, concrete, or superimposed loads. Deflection shall be determined by use of a deflection device or by use of a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. The ball, cylinder, or circular sections shall have a diameter, or minor diameter as applicable, of 92.5 percent of the inside diameter of the pipe, but 95 percent for RPMP and RTRP. A tolerance of plus 0.5 percent will be permitted. The ball, cylinder, or circular sections shall be of a homogeneous material throughout, shall have a density greater than 1.0 as related to water at 39.2 degrees F, and shall have a surface brinell hardness of not less than 150. It shall be center bored and through bolted with a 1/4 inch minimum diameter steel shaft having a yield strength of 70,000 psi or more, with eyes at each end for attaching pulling cables. The eye shall be suitably backed with flange or heavy washer such that a pull exerted on the opposite end of the shaft shall produce compression throughout the remote end of the ball, cylinder or circular section. Circular sections shall be so spaced that the distance from the external faces of the front and back sections shall equal or exceed the diameter of the circular section. Failure of the ball, cylinder, or circular section to pass freely through a pipe run, either by being pulled through or by being flushed through with water, shall be cause for rejection of that run. When a deflection device is used for the test in lieu of the ball, cylinder, or circular sections described, such device shall be approved prior to use. The device shall be sensitive to 1.0

percent of the diameter of the pipe being measured and shall be accurate to 1.0 percent of the indicated dimension. Installed pipe showing deflections greater than 7.5 percent of the normal diameter of the pipe, or 5 percent for RTRP and RPMP, shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced at no cost to the Government.

3.2 CONCRETE CRADLE AND ENCASEMENT

The pipe shall be supported on a concrete cradle, or encased in concrete where indicated or directed.

3.3 WYE BRANCHES

Wye branches shall be installed where sewer connections are indicated or where directed. Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence by the Contractor shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and cement mortar.

3.4 MANHOLES

3.4.1 General

Manholes shall be constructed of glass-fiber-reinforced polyester, prefabricated plastic, concrete, or precast concrete manhole sections. The invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be built up with brick and mortar, or shall be half tile laid in concrete, or shall be constructed by laying full section sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. Pipe connections shall be made to manhole using water stops, standard O-ring joints, special manhole coupling, or shall be made in accordance with the manufacturer's recommendation. The Contractor's proposed method of connection, list of materials selected, and specials required, shall be approved prior to installation. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 1 inch per foot nor more than 2 inches per foot. Free drop inside the manholes shall not exceed 1 foot 6 inches, measured from the invert of the inlet pipe to the top of the floor of the manhole outside the channels, and drop manholes shall be constructed whenever the free drop would otherwise be greater than 1 foot 6 inches.

3.4.2 Steel Ladder

Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 6 feet apart vertically, and shall be installed to provide at least 6 inches of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.

3.4.3 Jointing, Plastering and Sealing

Mortar joints shall be completely filled and shall be smooth and free from surplus mortar on the inside of the manhole. Mortar and mastic joints between precast rings shall be full-bedded in jointing compound and shall be smoothed to a uniform surface on both the interior and exterior of the manhole. Installation of rubber gasket joints between precast rings shall be in accordance with the recommendations of the manufacturer. Precast rings may also be sealed by the use of extruded rolls of rubber with mastic adhesive on one side.

3.4.4 Frames and Covers

Unless otherwise indicated, tops of frames and covers shall be set flush with finished grade in paved areas or 2 inches higher than finished grade in unpaved areas. Frame and cover assemblies shall be sealed to manhole sections using external preformed rubber joint seals that meet the requirements of ASTM D 412 and ASTM D 624, or other methods specified in paragraph Jointing, Plastering and Sealing, unless otherwise specified.

3.4.5 External Preformed Rubber Joint Seals

External preformed rubber joint seals and extruded rolls of rubber with mastic adhesive shall meet the requirements of ASTM D 412 and ASTM C 972 to ensure conformance with paragraph Leakage Tests. The seal shall be multi-section with neoprene rubber top section and all lower sections made of Ethylene Propylene Di Monomer (EPDM) rubber with a minimum thickness of 60 mils. Each unit shall consist of a top and a bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. One unit shall seal a casting and up to six, 2 inch adjusting rings. The bottom section will be 12 inches in height. A 6 inch high top section will cover up to two, 2 inch adjusting rings. A 12 inch high bottom section will cover up to six, 2 inch adjusting rings. Extension sections shall cover up to two more adjusting rings. Each extension shall overlap the bottom section by 2 inches and shall be overlapped by the top section by 2 inches.

3.6 BUILDING CONNECTIONS

Building connections shall include the lines to and connection with the building waste drainage piping at a point approximately 5 feet outside the building, unless otherwise indicated. Where building drain piping is not installed, the Contractor shall terminate the building connections approximately 5 feet from the site of the building at a point and in a manner designated.

3.7 CLEANOUTS AND OTHER APPURTENANCES

Cleanouts and other appurtenances shall be installed where shown on the drawings or as directed by the Contracting Officer, and shall conform to

the detail of the drawings.

-- End of Section --

SECTION 02754
CONCRETE PAVEMENTS FOR SMALL PROJECTS
07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 301	(1996) Standard Specification for Structural Concrete
ACI 305R	(1991) Hot Weather Concreting

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 184	(1990) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 615	(1996) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 31	(1996) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1993) Concrete Aggregates
ASTM C 39	(1996) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 94	(1996) Ready-Mixed Concrete
ASTM C 123	(1994) Lightweight Pieces in Aggregate
ASTM C 143	(1990a) Slump of Hydraulic Cement Concrete
ASTM C 150	(1996) Portland Cement
ASTM C 192	(1990a) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1991b) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(1995) Air-Entraining Admixtures for

Concrete

ASTM C 494	(1992) Chemical Admixtures for Concrete
ASTM C 595	(1995a) Blended Hydraulic Cements
ASTM C 618	(1996a) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
ASTM C 666	(1992) Resistance of Concrete to Rapid Freezing and Thawing
ASTM C 881	(1990) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 989	(1994a) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 1077	(1995a) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

ARMY CORPS OF ENGINEERS (COE)

COE CRD-C 130	(1989) Scratch Hardness of Coarse Aggregate Particles
COE CRD-C 300	(1990) Specifications for Membrane-Forming Compounds for Curing Concrete
COE CRD-C 540	(1971; R 1981) Standard Specification for Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(1990) Concrete Plant Standards
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1.2 SYSTEM DESCRIPTION

This section is intended to stand alone for construction of concrete (rigid) pavement. However, where the construction covered herein interfaces with other sections, the construction at each interface shall

conform to the requirements of both this section and the other section, including tolerances for both.

1.3 ACCEPTABILITY OF WORK

The pavement will be accepted on the basis of tests made by the Government and by the Contractor or its suppliers, as specified herein. The Government may, at its discretion, make check tests to validate the results of the Contractor's testing. Concrete samples shall be taken by the Contractor at the placement to determine the slump, air content, and strength of the concrete. Test cylinders shall be made for determining conformance with the strength requirements of these specifications and, when required, for determining the time at which pavements may be placed into service. All air content measurements shall be determined in accordance with ASTM C 231. All slump tests shall be made in accordance with ASTM C 143. All test cylinders shall be 6 by 12 inch cylinders and shall be fabricated in accordance with ASTM C 192, using only steel molds, cured in accordance with ASTM C 31, and tested in accordance with ASTM C 39. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory.

1.3.1 Evaluation Sampling

Sampling, testing, and mixture proportioning shall be performed by a commercial Testing Laboratory, conforming with ASTM C 1077. The individuals who sample and test concrete and concrete constituents shall be certified as American Concrete Institute (ACI) Concrete Field Testing Technicians, Grade I. The individuals who perform the inspection of concrete shall be certified as ACI Concrete Construction Inspector, Level II. All mix design, weekly quality control reports, smoothness reports, and project certification reports shall be signed by a Registered Engineer.

1.3.2 Surface Testing

Surface testing for surface smoothness and plan grade shall be performed as indicated below by the Testing Laboratory. The measurements shall be properly referenced in accordance with paving lane identification and stationing, and a report given to the Government within 24 hours after measurement is made. A final report of surface testing, signed by a Registered Engineer, containing all surface measurements and a description of all actions taken to correct deficiencies, shall be provided to the Government upon conclusion of surface testing.

1.3.2.1 Surface Smoothness Requirements

The finished surfaces of the pavements shall have no abrupt change of 1/8 inch or more, and all pavements shall be within the tolerances specified in Table 1 when checked with the straightedge.

TABLE 1
STRAIGHTEDGE SURFACE SMOOTHNESS--PAVEMENTS

Pavement Category	Direction of Testing	Tolerances inches
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TABLE 1
STRAIGHTEDGE SURFACE SMOOTHNESS--PAVEMENTS

Pavement Category	Direction of Testing	Tolerances inches
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Roads and Streets	Longitudinal Transverse	3/16 1/4

1.3.2.2 Surface Smoothness Testing Method

The surface of the pavement shall be tested with the straightedge to identify all surface irregularities exceeding the tolerances specified above. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines approximately 15 feet apart. The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length and measuring the maximum gap between the straightedge and the pavement surface, in the area between these two high points.

1.3.3 Edge Slump Testing and Conformance

When slip-form paving is used, not more than 15 percent of the total free edge [of any 10 inch or thicker slab] of the slipformed portion of the pavement, shall have an edge slump exceeding 1/4 inch and no slab shall have an edge slump exceeding 3/8 inch. Edge slump shall be determined as above for surface smoothness, at each free edge of each slipformed paving lane constructed. Measurements shall be made at 5 to 15 foot spacings, and as directed. When edge slump exceeding the limits specified above is encountered on either side of the paving lane, additional straightedge measurements shall be made, if required, to define the linear limits of the excessive slump. The concrete for the entire width of the paving lane within these limits of excessive edge slump shall be removed and replaced. Adding concrete or paste to the edge or otherwise manipulating the plastic concrete after the sliding form has passed, or patching the hardened concrete, shall not be used as a method for correcting excessive edge slump.

1.3.4 Plan Grade Testing and Conformance

The finished surface of the pavements shall conform, within the tolerances shown in Table 1, to the lines, grades, and cross sections shown. The finished surface of new abutting pavements shall coincide at their juncture. The finished surface of airfield runway, taxiway, and apron pavements shall vary not more than 0.04 foot above or below the plan grade line or elevation indicated. The surfaces of other pavements shall vary not more than 0.06 foot above or below the plan grade line or elevation

indicated. Each pavement category shall be checked by the Contractor for conformance with plan grade requirements by running lines of levels at intervals to determine the elevation at each joint intersection.

1.4 PRECONSTRUCTION TESTING OF MATERIALS

The Contractor shall not be entitled to any additional payment or extension of time because of delays caused by sampling and testing additional sources, or samples, necessitated by failure of any samples. Aggregates shall be sampled and tested by the Test Laboratory and shall be representative of the materials to be used for the project. Test results, signed by a Registered Engineer, shall be submitted 45 days before commencing paving. No aggregate shall be used unless test results show that it meets all requirements of these specifications, including compliance with ASTM C 33 and deleterious materials limitations.

1.5 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Schedules

Paving; FIO

Paving Schedules at least 7 days prior to start of paving.

SD-08 Statements

Mixture Proportions; GA.

The report of the Contractor's mixture proportioning studies showing the proportions of all ingredients and supporting information on aggregate and other materials that will be used in the manufacture of concrete, at least 14 days prior to commencing concrete placing operations.

1.6 EQUIPMENT

1.6.1 Batching and Mixing

The batching plant shall conform to NRMCA CPMB 100, the equipment requirements in ASTM C 94, and as specified. Water shall not be weighed or measured cumulatively with another ingredient. All concrete materials batching shall meet ASTM C 94 requirements. Mixers shall be stationary mixers or truck mixers. Batching, mixers, mixing time, permitted reduction of mixing time, and concrete uniformity shall meet the requirements of ASTM C 94, and shall be documented in the initial weekly QC Report.

1.6.2 Transporting Equipment

Transporting equipment shall be in conformance with ASTM C 94 and as specified herein. Concrete shall be transported to the paving site in rear-dump trucks, in truck mixers designed with extra large blading and rear opening specifically for low slump concrete, or in agitators. Bottom-dump trucks shall not be used for delivery of concrete.

1.6.3 Delivery Equipment

When concrete transport equipment cannot operate on the paving lane, side-delivery transport equipment consisting of self-propelled moving conveyors shall be used to deliver concrete from the transport equipment and discharge it in front of the paver. Front-end loaders, dozers, or similar equipment shall not be used to distribute the concrete.

1.6.4 Paver-Finisher

The paver-finisher shall be a heavy-duty, self-propelled machine designed specifically for paving and finishing high quality pavement. The paver-finisher shall spread, consolidate, and shape the plastic concrete to the desired cross section in one pass. The paver-finisher shall be equipped with a full width "knock-down" auger, capable of operating in both directions, which will evenly spread the fresh concrete in front of the screed or extrusion plate. Immersion vibrators shall be gang mounted at the front of the paver on a frame equipped with suitable controls so that all vibrators can be operated at any desired depth within the slab or completely withdrawn from the concrete. The vibrators shall be automatically controlled so that they will be immediately stopped as forward motion of the paver ceases. The spacing of the immersion vibrators across the paving lane shall be as necessary to properly consolidate the concrete, but the clear distance between vibrators shall not exceed 30 inches, and the outside vibrators shall not exceed 12 inches from the edge of the lane. The paver-finisher shall be equipped with a transversely oscillating screed or an extrusion plate to shape, compact, and smooth the surface.

1.6.4.1 Paver-Finisher with Fixed Forms

The paver-finisher shall be equipped with wheels designed to ride the forms, keep it aligned with the forms, and to spread the preventing deformation of the forms.

1.6.4.2 Slipform Paver-Finisher

The slipform paver-finisher shall be automatically controlled and crawler mounted with padded tracks. Horizontal alignment shall be electronically referenced to a taut wire guideline. Vertical alignment shall be electronically referenced on both sides of the paver to a taut wire guideline, to an approved laser control system, or to a ski operating on a completed lane. Control from a slope-adjustment control or control operating from the underlying material shall not be used.

1.6.5 Curing Equipment

Equipment for curing is specified in paragraph CURING.

1.6.6 Texturing Equipment

Texturing equipment shall be as specified below.

1.6.6.1 Fabric Drag

A fabric drag shall consist of a piece of fabric material as wide as the lane width securely attached to a separate wheel mounted frame spanning the

paving lane or to one of the other similar pieces of equipment. The material shall be wide enough to provide 12 to 18 inches dragging flat on the pavement surface. The fabric material shall be clean, reasonably new burlap, kept clean and saturated during use.

1.7.6.2 Deep Texturing Equipment

Texturing equipment shall consist of a stiff bristled broom forming a drag at least 4 feet long. This drag shall be mounted in a wheeled frame spanning the paving lane and constructed to mechanically pull the drag in a straight line across the paving lane perpendicular to the centerline.

1.7.7 Sawing Equipment

Equipment for sawing joints and for other similar sawing of concrete shall be standard diamond-tip-bladed concrete saws mounted on a wheeled chassis.

1.7.8 Straightedge

The Contractor shall furnish and maintain at the job site one 12 foot straightedge for testing concrete surface smoothness. The straightedge shall be constructed of aluminum or magnesium alloy and shall have blades of box or box-girder cross section with flat bottom, adequately reinforced to insure rigidity and accuracy. Straightedges shall have handles for operation on the pavement.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious materials shall be only portland cement in combination with pozzolan and shall conform to appropriate specifications listed below.

2.1.1 Portland Cement

Portland cement shall conform to ASTM C 150 Type II, low-alkali

2.1.2 Pozzolan (Fly Ash)

Fly ash shall conform to ASTM C 618 Class F, including all the supplementary optional physical requirements.

2.2 AGGREGATES

Aggregates shall consist of clean, hard, uncoated particles meeting the requirements of ASTM C 33, including deleterious materials, abrasion loss and soundness requirements of ASTM C 33, and other requirements specified herein.

2.2.1 Coarse Aggregate

Coarse aggregate shall consist of crushed gravel, crushed stone, or a combination thereof. The nominal maximum size of the coarse aggregate shall be 1-1/2 inches. When the nominal maximum size is greater than 1 inch, the aggregates shall be furnished in two ASTM C 33 size groups, No. 67 and No. 4. The amount of deleterious material in each size of coarse aggregate shall not exceed the limits shown in ASTM C 33

Class 1N, 4M or 4S, depending on the weathering region, and the following limits:

- a. Lightweight particles 1.0 max. percent by mass (ASTM C 123).
- b. Other soft particles 2.0 max. percent by mass (COE CRD-C 130).
- c. Total of all deleterious 5.0 max. percent by mass (substances listed in ASTM C 33 and above, exclusive of material finer than No. 200 sieve).
- d. The separation medium for lightweight particles shall have a density of Sp. Gr. of 2.0.

2.2.2 Fine Aggregate

Fine aggregate shall consist of natural sand, manufactured sand, or a combination of the two, and shall be composed of clean, hard, durable particles. All fine aggregate shall be composed of clean, hard, durable particles meeting the requirements of ASTM C 33 and the requirements herein. The amount of deleterious material in the fine aggregate shall not exceed the limits in ASTM C 33 and shall not exceed the following limits:

- a. Lightweight particles (ASTM C 123) 1.0 percent max. by mass using a medium with a density of Sp. Gr. of 2.0.
- b. The total of all deleterious material types, listed in ASTM C 33 and above, shall not exceed 3.0 percent of the mass of the fine aggregate.

2.3 CHEMICAL ADMIXTURES

Air-entraining admixture shall conform to ASTM C 260. An accelerator shall be used only when specified in paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES and shall not be used to reduce the amount of cementitious material used. Accelerator shall conform to ASTM C 494 Type C. Calcium chloride and admixtures containing calcium chloride shall not be used. A water-reducing or retarding admixture shall meet the requirements of ASTM C 494. Type G or H admixtures are not allowed.

2.4 CURING MATERIALS

Membrane forming curing compound shall be a white pigmented compound conforming to COE CRD-C 300. Burlap shall be new or shall be clean material never used for anything other than curing concrete.

2.5 WATER

Water for mixing and curing shall be clean, potable, and free of injurious amounts of oil, acid, salt, or alkali.

2.6 JOINT MATERIALS

2.6.1 Expansion Joint Material

Expansion joint filler shall be a preformed material conforming to ASTM D 1751. Expansion joint filler shall be 3/4 inch thickness as shown.

2.6.2 Slip Joint Material

Slip joint material shall be 1/4 inch thick expansion joint filler conforming to ASTM D 1751 or ASTM D 1752.

2.7 REINFORCING

2.7.1 General

Reinforcing bars shall conform to ASTM A 615 Grade 60. Bar mats shall conform to ASTM A 184. Reinforcement shall be free from loose, flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce the bond with concrete.

2.8 DOWELS AND TIE BARS

2.8.1 Dowels

Dowels shall be single piece, plain non-deformed steel bars conforming to ASTM A 615 Grade 60 or higher. Dowels shall be free of loose, flaky rust and loose scale and shall be clean and straight.

2.8.2 Tie Bars

Tie bars shall be deformed steel bars conforming to ASTM A 615 Grade 60. Grade 60 or higher shall not be used for bars that are bent and straightened during construction.

2.9 SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES

Specified compressive strength, f'_c , for concrete is 4000 psi at 28 days. Maximum allowable water-cementitious material ratio is 0.45. The water-cementitious material ratio is based on absolute volume equivalency, where the ratio is determined using the weight of cement for a cement only mix, or using the total volume of cement plus pozzolan converted to an equivalent weight of cement by the absolute volume equivalency method described in ACI 211.1. The concrete shall be air-entrained with a total air content of 6 plus or minus 1 percent. The maximum allowable slump of the concrete shall be 3 inches for pavement constructed with fixed forms. For slipformed pavement, the maximum allowable slump shall be 1-1/4 inches. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'_c no individual test result falls below the specified strength f'_c by more than 500 psi and meets minimum flexural strength. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.

2.10 MIXTURE PROPORTIONS

2.10.1 Composition Concrete

Composition concrete shall be composed of cementitious material, water, fine and coarse aggregates, and admixtures. Fly ash, if used, shall be used only at a rate between 15 and 35 percent by mass of the total cementitious material. Admixtures shall consist of air entraining admixture and may also include water-reducing admixture.

No substitutions shall be made in the materials used in the mixture proportions without additional tests to show that the quality of the concrete is satisfactory.

2.10.2 Concrete Mixture Proportioning Studies

Trial design batches, mixture proportioning studies, and testing shall be the responsibility of the Contractor, and shall be performed by the Test Laboratory and signed by a Registered Engineer. No concrete pavement shall be placed until the Contracting Officer has approved the Contractor's mixture proportions. All materials used in mixture proportioning studies shall be representative of those proposed for use on the project. If there is a change in materials, additional mixture design studies shall be made using the new materials. Trial mixtures having proportions, slumps, and air content suitable for the work shall be based on methodology described in ACI 211.1. At least three different water-cementitious ratios, which will produce a range of strength encompassing that required on the project, shall be used. Laboratory trial mixtures shall be proportioned for maximum permitted slump and air content. Maximum sand content shall be 40 percent of the total aggregate SSD weight. Aggregate quantities shall be based on the mass in a saturated surface dry condition.

2.10.3 Mixture Proportioning Procedure

The Contractor shall perform the following:

- a. Fabricate, cure and test 6 test cylinders per age for each mixture at 7 and 28 days.
- b. Using the average strength for each $w/(c+p)$, plot the results from each of the three mixtures on separate graphs for $w/(c+p)$ versus 28-day strength.
- c. From the graphs select a $w/(c+p)$ which will produce a mixture giving a 28-day strength equal to the required strength determined in accordance with the following paragraph.

2.10.4 Average Strength Required for Mixtures

In order to ensure meeting, during production, the strength requirements specified, the mixture proportions selected shall produce a required average strength, f'_{cr} , exceeding the specified strength, f'_c , in accordance with procedures in Chapter 3 of ACI 301, "Proportioning."

PART 3 EXECUTION

3.1 CONDITIONING OF UNDERLYING MATERIAL

Underlying material, subgrade, upon which concrete is to be placed shall be clean, damp, and free from debris, waste concrete or cement, frost, ice, and standing or running water. After the underlying material has been prepared for concrete placement, no equipment shall be permitted thereon.

3.2 WEATHER LIMITATIONS

3.2.1 Hot Weather Paving

The temperature of concrete shall not exceed 90 degrees F. Steel forms, dowels and reinforcing shall be cooled prior to concrete placement when steel temperatures are greater than 120 degrees F. Recommendations of ACI 305R shall be strictly followed

3.2.2 Cold Weather Paving

The ambient temperature of the air at the placing site and the temperature of surfaces to receive concrete shall be not less 40 degrees F. The temperature of the concrete when placed shall be not less than 50 degrees F. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, chemical admixture conforming to ASTM C 494 Type C or E may be used provided it contains no calcium chloride. Calcium chloride shall not be used at any time. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period. Pavement damaged by freezing shall be completely removed and replaced at the Contractor's expense as specified in paragraph, REPAIR, REMOVAL, AND REPLACEMENT OF SLABS.

3.3 CONCRETE PRODUCTION

3.3.1 General Requirements

Concrete shall be deposited in front of the paver within 45 minutes from the time cement has been charged into the mixing drum, except that if the ambient temperature is above 90 degrees F, the time shall be reduced to 30 minutes. Every load of concrete delivered to the paving site shall be accompanied by a batch ticket from the operator of the batching plant. Tickets shall show at least the mass, or volume, of all ingredients in each batch delivered, the water meter and revolution meter reading on truck mixers and the time of day. Tickets shall be delivered to the placing foreman who shall keep them on file and deliver them to the Government daily.

3.3.2 Transporting and Transfer-Spreading Operations

Non-agitating equipment shall be used only on smooth roads and for haul time less than 15 minutes. No equipment shall be allowed to operate on the prepared and compacted underlying material in front of the paver-finisher. Additional water may be added to truck mixers to bring the slump within the specified range provided the mixture water-cement ratio is not exceeded.

3.4 PAVING

Pavement shall be constructed with paving and finishing equipment utilizing either fixed forms or slipforms.

3.4.1 Consolidation

The paver vibrators shall be inserted into the concrete not closer to the underlying material than 2 inches. The vibrators or any tamping units in front of the paver shall be automatically controlled so that they shall be stopped immediately as forward motion ceases. Excessive vibration shall not be permitted. Concrete in small, odd-shaped slabs or in locations

inaccessible to the paver mounted vibration equipment shall be vibrated with a hand-operated immersion vibrator. Vibrators shall not be used to transport or spread the concrete.

3.4.2 Operation

When the paver is operated between or adjacent to previously constructed pavement (fill-in lanes), provisions shall be made to prevent damage to the previously constructed pavement, including keeping the existing pavement surface free of any debris, and placing rubber mats beneath the paver tracks. Transversely oscillating screeds and extrusion plates shall overlap the existing pavement the minimum possible, but in no case more than 8 inches.

3.4.3 Required Results

The paver-finisher shall be operated to produce a thoroughly consolidated slab throughout, true to line and grade within specified tolerances. The paver-finishing operation shall produce a surface finish free of irregularities, tears, voids of any kind, and any other discontinuities. It shall produce only a very minimum of paste at the surface. Multiple passes of the paver-finisher shall not be permitted. The equipment and its operation shall produce a finished surface requiring no hand finishing, other than the use of cutting straightedges, except in very infrequent instances. No water, other than true fog sprays (mist), shall be applied to the concrete surface during paving and finishing.

3.4.4 Fixed Form Paving

Forms shall be steel, except that wood forms may be used for curves having a radius of 150 feet or less, and for fillets. Forms may be built up with metal or wood, added only to the base, to provide an increase in depth of not more than 25 percent. The base width of the form shall be not less than eight-tenths of the vertical height of the form, except that forms 8 inches or less in vertical height shall have a base width not less than the vertical height of the form. Wood forms for curves and fillets shall be adequate in strength and rigidly braced. Forms shall be set on firm material cut true to grade so that each form section when placed will be firmly in contact with the underlying layer for its entire base. Forms shall not be set on blocks or on built-up spots of underlying material. Forms shall remain in place at least 12 hours after the concrete has been placed. Forms shall be removed without injuring the concrete.

3.4.5 Slipform Paving

The slipform paver shall shape the concrete to the specified and indicated cross section in one pass, and shall finish the surface and edges so that only a very minimum amount of hand finishing is required. Dowels shall not be installed by dowel inserters attached to the paver or by any other means of inserting the dowels into the plastic concrete. If a keyway is required, a 26 gauge thick metal keyway liner shall be installed as the keyway is extruded. The keyway liner shall be protected and shall remain in place and become part of the joint.

3.4.6 Placing Reinforcing Steel

Reinforcement shall be positioned on suitable chairs securely fastened to

the subgrade prior to concrete placement, or may be placed on an initial layer of consolidated concrete, with the subsequent layer placed within 30 minutes of the first layer placement.

3.4.7 Placing Dowels and Tie Bars

Dowels shall be installed with alignment not greater than 1/8 inch per ft.

Except as otherwise specified below, location of dowels shall be within a horizontal tolerance of plus or minus 5/8 inch and a vertical tolerance of plus or minus 3/16 inch. The portion of each dowel intended to move within the concrete or expansion cap shall be painted with one coat of rust inhibiting primer paint, and then oiled just prior to placement. Dowels and tie bars in joints shall be omitted when the center of the dowel tie bar is located within a horizontal distance from an intersecting joint equal to or less than one-fourth of the slab thickness.

3.4.7.1 Joints

Dowels and tie bars in longitudinal and transverse contraction joints within the paving lane shall be held securely in place by means of rigid metal basket assemblies. The dowels and tie bars shall be welded to the assembly or held firmly by mechanical locking arrangements that will prevent them from becoming distorted during paving operations. The basket assemblies shall be held securely in the proper location by means of suitable anchors.

3.4.7.2 Construction Joints-Fixed Form Paving

Installation of dowels and tie bars shall be by the bonded-in-place method, supported by means of devices fastened to the forms. Installation by removing and replacing in preformed holes will not be permitted.

3.4.7.3 Dowels Installed in Hardened Concrete

Installation shall be by bonding the dowels into holes drilled into the hardened concrete. Holes approximately 1/8 inch greater in diameter than the dowels shall be drilled into the hardened concrete. Dowels shall be bonded in the drilled holes using epoxy resin injected at the back of the hole before installing the dowel and extruded to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel shall not be permitted. The dowels shall be held in alignment at the collar of the hole, after insertion and before the grout hardens, by means of a suitable metal or plastic collar fitted around the dowel. The vertical alignment of the dowels shall be checked by placing the straightedge on the surface of the pavement over the top of the dowel and measuring the vertical distance between the straightedge and the beginning and ending point of the exposed part of the dowel. Where tie bars are required in longitudinal construction joints of slipform pavement, bent tie bars shall be installed at the paver, in front of the transverse screed or extrusion plate. If tie bars are required, a standard keyway shall be constructed, and the bent tie bars shall be inserted into the plastic concrete through a 26 gauge thick metal keyway liner. Tie bars shall not be installed in preformed holes. The keyway liner shall be protected and shall remain in place and become part of the joint. Before placement of the adjoining paving lane, the tie bars shall be straightened, without spalling the concrete around the bar.

3.5 FINISHING

Clary screeds, "bridge deck" finishers, or other rotating pipe or tube type equipment shall not be permitted. The sequence of machine operations shall be transverse finishing, longitudinal machine floating if used, straightedge finishing, texturing, and then edging of joints. Hand finishing shall be used only infrequently and only on isolated areas of odd slab shapes and in the event of a breakdown of the mechanical finishing equipment. Supplemental hand finishing for machine finished pavement shall be kept to an absolute minimum. Equipment to be used for supplemental hand finishing shall primarily be 10 to 12 feet cutting straightedges; only very sparing use of bull floats shall be allowed. At no time shall water be added to the surface of the slab in any way, except for fog (mist) sprays to prevent plastic shrinkage cracking.

3.5.1 Machine Finishing With Fixed Forms

The machine shall be designed to ride the forms. Machines that cause displacement of the forms shall be replaced. The machine shall make only one pass over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, the operation shall be immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

3.5.2 Machine Finishing With Slipform Pavers

If there is sufficient concrete slurry or fluid paste on the surface that it runs over the edge of the pavement, the paving operation shall be immediately stopped and the equipment, mixture, or operation modified to prevent formation of such slurry. Any slurry which does run down the vertical edges shall be immediately removed. No slurry, concrete or concrete mortar shall be used to build up along the edges of the pavement to compensate for excessive edge slump, either while the concrete is plastic or after it hardens.

3.5.3 Surface Correction

While the concrete is still plastic, irregularities and marks in the pavement surface shall be eliminated by means of cutting straightedges, 10 to 12 feet in length. Depressions shall be filled with freshly mixed concrete, struck off, consolidated, and refinished. Projections above the required elevation shall also be struck off and refinished. Long-handled, flat "bull floats" shall be used sparingly and only as necessary to correct minor, scattered surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Joints and edges shall not be overfinished.

3.5.4 Hand Finishing

Hand finishing operations shall be used only for those unusual slabs as specified previously. Grate tampers (jitterbugs) shall not be used. As soon as placed and vibrated, the concrete shall be struck off and screeded. The surface shall be tamped with a strike-off and tamping screed, or vibratory screed. Immediately following the final tamping of the surface, the pavement shall be floated longitudinally. Long-handled, flat bull floats shall be used sparingly and only as necessary to correct surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Joints and edges shall not be overfinished. No water shall be added to the pavement during finishing operations.

3.5.5 Texturing

Before the surface sheen has disappeared and before the concrete hardens, the surface of the pavement shall be given a texture as described herein. After curing is complete, all textured surfaces shall be thoroughly power broomed to remove all debris. Any type of transverse texturing shall produce grooves in straight lines across each lane within a tolerance of plus or minus 1/2 inch of a true line. The concrete in areas of recesses for tie-down anchors, lighting fixtures, and other outlets in the pavement shall be finished to provide a surface of the same texture as the surrounding area.

3.5.5.1 Fabric-Drag Surface Finish

Surface texture shall be applied by dragging the surface of the pavement, in the direction of the concrete placement, with a moist fabric drag. The dragging shall produce a uniform finished surface having a fine sandy texture without disfiguring marks.

3.5.5.2 Broom Texturing

Surface texture shall be applied using a mechanical stiff bristle broom drag of a type that will uniformly score the surface transverse to the pavement center line. The broom shall be capable of traversing the full width of the pavement in a single pass at a uniform speed and with a uniform pressure. Successive passes of the broom shall be overlapped the minimum necessary to obtain a uniformly textured surface. The scores should be uniform in appearance and approximately 1/16 inch in depth but not more than 1/8 inch in depth. Hand brooming will be permitted only on isolated odd shaped slabs or slabs where hand finishing is permitted.

3.5.6 Edging

The edges of slipformed lanes shall not be edged. After texturing has been completed, the edge of the slabs along the forms shall be carefully finished with an edging tool to form a smooth rounded surface of 1/8 inch radius. No water shall be added to the surface during edging.

3.6 CURING

Concrete shall be continuously protected against loss of moisture and rapid temperature changes for at least 7 days from the completion of finishing operations. Unhardened concrete shall be protected from rain and flowing water. During hot weather with low humidity and/or wind, the Contractor shall institute measures to prevent plastic shrinkage cracks from developing. ACI 305R contains means of predicting plastic shrinkage cracking and preventative measures. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry. Curing shall be accomplished by one of the following methods.

3.6.1 Membrane Curing

A uniform coating of white-pigmented membrane-forming curing compound shall be applied to the entire exposed surface of the concrete including pavement edges as soon as the free water has disappeared from the surface after finishing. If evaporation is high and no moisture is present on the

surface even though bleeding has not stopped, fog sprays shall be used to keep the surface moist until setting of the cement occurs. Curing compound shall then be immediately applied. Curing compound shall be applied to the finished surfaces by means of a self-propelled automatic spraying machine, equipped with multiple spraying nozzles with wind shields, spanning the newly paved lane. The curing compound shall be applied at a maximum application rate of 200 square feet per gallon. The application of curing compound by hand-operated, mechanical powered pressure sprayers will be permitted only on odd widths or shapes of slabs where indicated and on concrete surfaces exposed by the removal of forms. The compound shall form a uniform, continuous, cohesive film that will not check, crack, or peel and that will be free from pinholes and other discontinuities. Areas where the curing compound develops the above defects or is damaged by heavy rainfall, sawing or other construction operations within the curing period, shall be immediately resprayed.

3.6.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Impervious sheet curing shall not be used.

3.7 JOINTS

No deviation from the jointing pattern shown on the drawings shall be made without written approval of the Design District Pavement or Geotechnical Engineer. All joints shall be straight, perpendicular to the finished grade of the pavement, and continuous from edge to edge or end to end of the pavement with no abrupt offset and no gradual deviation greater than 1/2 inch.

3.7.1 Longitudinal Construction Joints

Keys shall be installed in the longitudinal construction joints and the edges shall be thickened as indicated. The dimensions of the keyway shall not vary more than plus or minus 1/8 inch from the dimensions indicated and shall not deviate more than plus or minus 1/4 inch from the mid-depth of the pavement. If any length of completed keyway of 5 feet or more fails to meet the above tolerances, dowels shall be installed.

3.7.2 Transverse Construction Joints

Transverse construction joints shall be installed at a planned transverse joint, at the end of each day's placing operations and when concrete placement is interrupted and as shown. Transverse construction joints shall be constructed either by utilizing headers and hand placement and finishing techniques, or by placing concrete beyond the transverse construction joint location and then saw cutting full depth and removing concrete back to the transverse construction joint location. For the latter case, dowels shall be installed using methods for dowels installed in hardened concrete described above. All transverse construction joints shall be dowelled.

3.7.3 Expansion Joints

Expansion joints shall be formed where indicated, and about any structures and features that project through or into the pavement, using preformed joint filler of the type, thickness, and width indicated, and shall extend the full slab depth. Edges of the concrete at the joint face shall be edged. The joint filler strips shall be installed to form a recess at the pavement surface to be filled with joint sealant. Expansion joints shall be constructed with dowels for load transfer as shown.

3.7.4 Slip Joints

Slip joints shall be installed the full depth of the slab using expansion joint preformed joint filler material attached to the face of the original concrete placement. A reservoir for joint sealant shall be constructed at the top of the joint. Edges of the joint face shall be edged.

3.7.5 Contraction Joints

Transverse and longitudinal contraction joints shall be of the weakened-plane or dummy type. Contraction joints shall be constructed by sawing a groove in the hardened concrete with a power-driven saw. .

3.7.5.1 Sawed Joints

Sawed contraction joints shall be constructed by sawing a groove in the concrete with a 1/8 inch blade to the indicated depth. The time of initial sawing shall vary depending on existing and anticipated weather conditions and shall be such as to prevent uncontrolled cracking of the pavement. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting the concrete without chipping, spalling, or tearing. The joints shall be sawed at the required spacing consecutively in the sequence of the concrete placement. Sawing at a given joint location shall be discontinued when a crack develops ahead of the saw cut. Immediately after the joint is sawed, the saw cut and adjacent concrete surface shall be thoroughly flushed with water until all waste from sawing is removed from the joint. The surface shall be resprayed with curing compound as soon as free water disappears. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed with cord or backer rod before the concrete in the region of the joint is resprayed with curing compound.

3.7.6 Thickened Edge Joints

Underlying material in the transition area shall meet the requirements for smoothness and compaction specified for all other areas of the underlying material.

3.8 REPAIR, REMOVAL, AND REPLACEMENT OF SLABS

New pavement slabs that contain full-depth cracks shall be removed and replaced, as specified herein at no cost to the Government. Removal and replacement shall be full depth, shall be full width of the paving lane, and the limit of removal shall be from each original transverse joint . The Contracting Officer will determine whether cracks extend full depth of the pavement and may require minimum 6 inch diameter cores to be drilled on the crack to determine depth of cracking. Cores shall be drilled and the hole later filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with epoxy resin. Drilling of

cores and refilling holes shall be at no expense to the Government. Cracks that do not extend full depth of slab shall be cleaned and then pressure injected with epoxy resin, Type IV, Grade 1. The Contractor shall ensure that the crack is not widened during epoxy resin injection. Where a full depth crack intersects the original transverse joint, the slab(s) containing the crack shall be removed and replaced, with dowels installed, as required below. Spalls along joints shall be repaired as specified.

3.8.1 Removal and Replacement of Full Slabs

Unless there are keys or dowels present, all edges of the slab shall be sawcut full depth. If keys, dowels, or tie bars are present along any edges, these edges shall be sawed full depth 6 inches from the edge if only keys are present, or just beyond the end of dowels or tie bars if they are present. These joints shall then be carefully sawed on the joint line to within 1 inch of the depth of the dowel or key. The main slab shall be further divided by sawing full depth, at appropriate locations, and each piece lifted out and removed. The narrow strips along keyed or doweled edges shall be carefully broken up and removed. Care shall be taken to prevent damage to the dowels, tie bars, or keys or to concrete to remain in place. Protruding portions of dowels shall be painted and lightly oiled. The joint face below keys or dowels shall be suitably trimmed so that there is no abrupt offset. If underbreak occurs at any point along any edge, the area shall be hand-filled with concrete, producing an even joint face from top to bottom, before replacing the removed slab. If underbreak over 4 inches deep occurs, the entire slab containing the underbreak shall be removed and replaced. Where there are no dowels, tie bars, or keys on an edge, or where they have been damaged, dowels of the size and spacing as specified for other joints in similar pavement shall be installed by epoxy grouting them into holes drilled into the existing concrete. Original damaged dowels or tie bars shall be cut off flush with the joint face. All four edges of the new slab shall thus contain dowels or original keys or original tie bars. Prior to placement of new concrete, the underlying material shall be graded and recompact, and the surfaces of all four joint faces shall be cleaned of all loose material and contaminants, and coated with a double application of membrane forming curing compound as bond breaker. Placement of concrete shall be as specified for original construction. The resulting joints around the new slab shall be prepared and sealed as specified.

3.8.2 Repairing Spalls Along Joints

Spalls along joints and cracks shall be repaired by first making a vertical saw cut at least 1 inch outside the spalled area and to a depth of at least 2 inches. Saw cuts shall be straight lines forming rectangular areas. The concrete between the saw cut and the joint, or crack, shall be chipped out to remove all unsound concrete. The cavity shall be thoroughly cleaned with high pressure water jets supplemented with compressed air to remove all loose material. Immediately before filling the cavity, a prime coat shall be applied to the dry cleaned surface of all sides and bottom of the cavity, except any joint face. The prime coat shall be applied in a thin coating and scrubbed into the surface with a stiff-bristle brush. Prime coat for portland cement repairs shall be a neat cement grout and for epoxy resin repairs shall be epoxy resin, Type III, Grade 1. The cavity shall be filled with low slump portland cement concrete or mortar, or with epoxy resin concrete or mortar. Portland cement concrete shall be used for larger spalls, those more than 1/3 cu. ft. in size after removal operations; portland cement mortar shall be used for spalls between 0.03

and 1/3 cu. ft; and epoxy resin mortar or Type III, Grade 3 epoxy resin for those spalls less than 0.03 cu. ft. in size after removal operations. Portland cement concretes and mortars shall be very low slump mixtures, proportioned, mixed, placed, tamped, and cured. If the materials and procedures are approved in writing, latex modified concrete mixtures may be used for repairing spalls less than 1/3 cu.ft. in size. Epoxy resin mortars shall be made with Type III, Grade 1, epoxy resin, using proportions, mixing, placing, tamping and curing procedures as recommended by the manufacturer. Any repair material on the surrounding surfaces of the existing concrete shall be removed before it hardens. Where the spalled area abuts a joint, an insert or other bond-breaking medium shall be used to prevent bond at the joint face. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints. [In lieu of sawing, spalls not adjacent to joints, and popouts, both less than 6 inches in maximum dimension, may be prepared by drilling a core 2 inches in diameter greater than the size of the defect, centered over the defect, and 2 inches deep or 1/2 inch into sound concrete, whichever is greater. The core hole shall be repaired as specified above for other spalls.]

3.8.3 Areas Defective in Plan Grade or Smoothness

In areas not meeting the specified limits for surface smoothness and plan grade, high areas shall be reduced to attain the required smoothness and grade, except as depth is limited below. High areas shall be reduced by grinding the hardened concrete with a surface grinding machine after the concrete is 14 days or more old. The depth of grinding shall not exceed 1/4 inch. All pavement areas requiring plan grade or surface smoothness corrections in excess of the specified limits, shall be removed and replaced. In pavement areas given a wire comb or tined texture, areas exceeding 25 square feet that have been corrected by rubbing or grinding shall be retextured by grooving machine sawn grooves meeting the requirements for the wire comb or tined texture. All areas in which grinding has been performed will be subject to the thickness tolerances specified in paragraph Thickness. Any grinding performed on individual slabs with excessive deficiencies shall be performed at the Contractor's own decision without entitlement to additional compensation if eventual removal of the slab is required.

3.9 PAVEMENT PROTECTION

The Contractor shall protect the pavement against all damage prior to final acceptance of the work. Traffic shall be excluded from the new pavement. As a construction expedient in paving intermediate lanes between newly paved pilot lanes, operation of the hauling equipment will be permitted on the new pavement after the pavement has been cured for 7 days and the joints have been sealed or otherwise protected. All new and existing pavement carrying construction traffic or equipment shall be continuously kept completely clean. Special cleaning and care shall be used where Contractor's traffic uses or crosses active airfield pavement.

3.10 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL (CQC)

Paragraph ACCEPTABILITY OF WORK contains additional CQC requirements. The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and submit reports as specified. When, in the opinion of the Contracting Officer, the paving operation is out of control, concrete placement shall cease.

3.10.1 Batch Plant Control

A daily report shall be prepared indicating checks made for scale accuracy with test weights, checks of batching accuracy, and corrective action taken prior to and during placement for weighing or batching, type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water masses per cubic yd, amount of water as free moisture in each size of aggregate, and the batch aggregate and water masses per cubic yd. for each class of concrete batched during each day's plant operation.

3.10.2 Concrete Mixture

- a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two other tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of paving. Whenever air content reaches specified limits, an immediate confirmatory test shall be made. If the second test also shows air content at or exceeding specified limits, an adjustment shall immediately be made in the amount of air-entraining admixture batched to bring air content within specified limits. If the next adjusted batch of concrete is not within specified limits, concrete placement shall be halted until concrete air content is within specified limits.
- b. Slump Testing. Slump tests shall be made when test specimens are fabricated. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Whenever slump approaches the maximum limit, an adjustment shall immediately be made in the batch masses of water and fine aggregate, without exceeding the maximum $w/(c+p)$. When a slump result exceeds the specification limit, no further concrete shall be delivered to the paving site until adjustments have been made and slump is again within the limit.
- c. Temperature. The temperature of the concrete shall be measured when strength specimens are fabricated.
- d. Concrete Strength Testing. Four (4) cylinders from the same batch shall be fabricated, cured and tested for compressive strength, testing two cylinders at 7-day and two cylinders at 28-day age. Control charts for strength, showing the 7-day and 28-day CQC compressive strengths, and the 28-day required compressive strength, shall be maintained and submitted with weekly CQC Reports.

3.10.3 Inspection Before Placing

Underlying materials, joint locations and types, construction joint faces, forms, reinforcing, dowels, and embedded items shall be inspected by a Registered Engineer in sufficient time prior to each paving operation in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing, and the certification signed by the Registered Engineer, prior to each day's paving.

3.10.4 Paving Operations

The placing foreman shall supervise all placing and paving operations, shall determine that the correct quality of concrete is placed in each location as shown, shall insure that the concrete is consolidated full depth and that finishing is performed as specified. The placing foreman shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume of concrete placed, and method of paving and any problems encountered.

3.10.5 Curing Inspection

- a. Moist Curing Inspections. Each day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded. When any inspection finds an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for the area shall be extended by 1 day.
- b. Membrane Curing Inspection. At the end of each day's placement, the CQC Representative shall determine the quantity of compound used by measurement of the container; shall determine the area of concrete surface covered; shall then compute the rate of coverage in square feet per gallon and shall also note whether or not coverage is uniform. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.

3.10.6 Cold-Weather Protection

At least once per day, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

3.10.7 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report, signed by a registered engineer, shall be prepared for the updating of control charts and test data, and all CQC inspections and actions covering the entire period from the start of the construction through the current week. Reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all CQC records. A copy of weekly reports shall be faxed to the Design District Pavement or Geotechnical Engineer. At the completion of concrete placement, a certification report shall be prepared containing mix designs, all updated control charts and concrete test data, quality control reports, smoothness reports, and other pertinent data on the concrete, with a certification by a registered engineer that the concrete placed meets all specification requirements. A copy of the certification report shall be mailed to the Design District pavement or Geotechnical Engineer.

-- End of Section --

SECTION 04200

MASONRY

07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI SP-66 (1994) ACI Detailing Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 82 (1994) Steel Wire, Plain, for Concrete Reinforcement

ASTM A 153 (1996) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 615 (1995) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM C 55 (1995) Concrete Building Brick

ASTM C 62 (1995) Building Brick (Solid Masonry Units Made from Clay or Shale)

ASTM C 67 (1994) Sampling and Testing Brick and Structural Clay Tile

ASTM C 90 (1995) Loadbearing Concrete Masonry Units

ASTM C 91 (1995) Masonry Cement

ASTM C 126 (1994) Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units

ASTM C 129 (1995) Nonloadbearing Concrete Masonry Units

ASTM C 140 (1995a) Sampling and Testing Concrete Masonry Units

ASTM C 216 (1995) Facing Brick (Solid Masonry Units Made from Clay or Shale)

ASTM C 270 (1995) Mortar for Unit Masonry

ASTM C 476	(1991) Grout for Masonry
ASTM C 494	(1992) Chemical Admixtures for Concrete
ASTM C 578	(1992) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 641	(1982; R 1991) Staining Materials in Lightweight Concrete Aggregates
ASTM C 652	(1994) Hollow Brick (Hollow Masonry Units Made From Clay or Shale)
ASTM C 744	(1995) Prefaced Concrete and Calcium Silicate Masonry Units
ASTM C 780	(1994) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C 1019	(1989a; R 1993) Sampling and Testing Grout
ASTM C 1072	(1994) Measurement of Masonry Flexural Bond Strength
ASTM C 1289	(1995) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D 2000	(1990; R 1994) Rubber Products in Automotive Applications
ASTM D 2240	(1991) Rubber Property - Durometer Hardness
ASTM D 2287	(1992) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM E 119	(1995a) Fire Tests of Building Construction and Materials
ASTM E 447	(1992b) Compressive Strength of Masonry Prisms

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Concrete Masonry Units; GA.; Franlin Mountain Stone; GA.

Manufacturer's descriptive data.

SD-04 Drawings

Masonry Work; GA.

Drawings showing the location and layout of masonry and stone units. Drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; and wall openings. Bar splice locations shall be shown. Bent bars shall be identified on a bending diagram and shall be referenced and located on the drawings. Wall dimensions, bar clearances, and wall openings greater than one masonry unit in area shall be shown. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during construction, additional masonry openings are required, the approved shop drawings shall be resubmitted with the additional openings shown along with the proposed changes. Location of these additional openings shall be clearly highlighted. The minimum scale for wall elevations shall be 1/4 inch per foot. Reinforcement bending details shall conform to the requirements of ACI SP-66.

SD-08 Statements

Cold Weather Installation; GA.

Cold weather construction procedures.

SD-09 Reports

Efflorescence Test; GA. Field Testing of Mortar; GA. Field Testing of Grout; GA. Prism tests; GA. Masonry Cement; GA. Fire-rated CMU; GA.

Test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project.

Special Inspection; GA.

Copies of masonry inspector reports.

SD-13 Certificates

Concrete Brick; FIO. Concrete Masonry Units (CMU); FIO. Franklin Mountain Stone Units; FIO. Control Joint Keys; FIO. Anchors, Ties, and Bar Positioners; FIO. Expansion-Joint Materials; FIO. Joint Reinforcement; FIO. Reinforcing Steel Bars and Rods; FIO. Masonry Cement; FIO. Mortar Coloring; FIO. Mortar Admixtures; FIO. Grout Admixtures; FIO.

Certificates of compliance stating that the materials meet the specified requirements.

SD-14 Samples

Concrete Masonry Units (CMU); GA. Stone Items; GA.

Color samples of three stretcher units and one unit for each type of special shape. Units shall show the full range of color and texture.

Anchors, Ties, and Bar Positioners; GA.

Two of each type used.

Expansion-Joint Material; GA.

One piece of each type used.

Joint Reinforcement; GA.

One piece of each type used, including corner and wall intersection pieces, howing at least two cross wires.

1.4 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered, handled, stored, and protected to avoid chipping, breakage, and contact with soil or contaminating material.

1.4.1 Masonry Units

Masonry units shall be covered or protected from inclement weather and shall conform to the moisture content as specified in ASTM C 90 when delivered to the jobsite. Prefabricated lintels shall be marked on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

1.4.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

1.4.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Sand and aggregates shall be stored in a manner to prevent contamination or segregation.

1.5 SPECIAL INSPECTION

A qualified masonry inspector approved by the Contracting Officer shall perform inspection of the masonry work. Minimum qualifications for the masonry inspector shall be 5 years of reinforced masonry inspection experience or acceptance by a State, municipality, or other governmental

body having a program of examining and certifying inspectors for reinforced masonry construction. The masonry inspector shall be present during preparation of masonry prisms, sampling and placing of masonry units, placement of reinforcement (including placement of dowels in footings and foundation walls), inspection of grout space, immediately prior to closing of cleanouts, and during grouting operations. The masonry inspector shall assure Contractor compliance with the drawings and specifications. The masonry inspector shall keep a complete record of all inspections and shall submit daily written reports to the Quality Control Supervisory Representative reporting the quality of masonry construction.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval.

2.4 CONCRETE MASONRY UNITS (CMU)

Hollow and solid concrete masonry units shall conform to ASTM C 90, Type I, Lightweight. Cement shall have a low alkali content and be of one brand.

2.4.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C 641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification.

2.4.2 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. In exposed interior masonry surfaces, units having a bullnose shall be used for vertical external corners except at door, window, and louver jambs. Radius of the bullnose shall be 1 inch. Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color.

2.4.2.2 Stone Screen Units

Stone screen units shall have uniform through-the-wall pattern, color, and texture and be representative of other stone walls on the base as directed by the Contracting Officer.

Concrete masonry units used in fire-rated construction shown on the drawings shall be of minimum equivalent thickness for the fire rating indicated and the corresponding type of aggregates indicated in TABLE I. Units containing more than one of the aggregates listed in TABLE I will be rated on the aggregate requiring the greater minimum equivalent thickness to produce the required fire rating.

2.8 PRECAST CONCRETE ITEMS

Trim, lintels, copings, splashblocks and door sills shall be factory-made units from a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, concrete shall be 4,000 psi minimum conforming to Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE using 1/2 inch to No. 4 nominal-size coarse aggregate, and minimum reinforcement shall be the reinforcement required for handling of the units. Clearance of (3/4 inch) shall be maintained between reinforcement and faces of units. Unless precast-concrete items have been subjected during manufacture to saturated-steam pressure of at least 120 pounds per square inch for at least 5 hours, the items, after casting, shall be either damp-cured for 24 hours or steam-cured and shall then be aged under cover for 28 days or longer. Cast-concrete members weighing over (80 pounds) shall have built-in loops of galvanized wire or other approved provisions for lifting and anchoring. Units shall have beds and joints at right angles to the face, with sharp true arises and shall be cast with drip grooves on the underside where units overhang walls. Exposed-to-view surfaces shall be free of surface voids, spalls, cracks, and chipped or broken edges. Precast units exposed-to-view shall be of uniform appearance and color. Unless otherwise specified, units shall have a smooth dense finish. Prior to use, each item shall be wetted and inspected for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.

2.8.1 Lintels

Precast lintels, unless otherwise shown, shall be of a thickness equal to the wall and reinforced with two No. 4 bars for the full length. Top of lintels shall be labeled "TOP" or otherwise identified and each lintel shall be clearly marked to show location in the structure.

2.8.2 Sills and Copings

Sills and copings shall be cast with washes. Sills for windows having mullions shall be cast in sections with head joints at mullions and a 1/4 inch allowance for mortar joints. The ends of sills, except a 3/4 inch wide margin at exposed surfaces, shall be roughened for bond. Treads of door sills shall have rounded nosings.

2.8.3 Splash Blocks

Splash blocks shall be as detailed. Reinforcement shall be the manufacturer's standard.

2.9 STONE ITEMS

Stone for trim, sills, lintels, and copings shall be limestone, sandstone, or granite, and shall be cut to the design shown. Sandstone shall be standard grade, buff, gray, or buff brown, with a smooth finish free from clay pits and tool marks. Granite shall be a good commercial grade building granite of medium or moderately coarse grain, and a light or medium gray or light pink color, with a smooth machine finish on washes, 4-cut finish on treads, and 6-cut or equivalent machine finish on other exposed surfaces. Limestone shall be standard buff limestone with a smooth machine finish free from tool marks. Lintels, except when supported by a steel member, shall be 4 inches or more thick from face to back edge and of the depth required to support the masonry over the opening. Stone shall

have beds and joints at right angles to the face, with sharp, true arises. Copings and sills shall be provided with washes, and where overhanging the walls, shall have drips cut on the underside.

2.10 MORTAR

Mortar shall be Type S in accordance with the proportion specification of ASTM C 270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate; when masonry cement ASTM C 91 is used the maximum air content shall be limited to 12 percent and performance equal to cement-lime mortar shall be verified. Evaluation of performance shall be based on ASTM C 780 and ASTM C 1072. Mortar for prefaced concrete masonry unit wainscots shall contain aggregates with 100 percent passing the No. 8 sieve and 95 percent passing the No. 16 sieve. Pointing mortar in showers and kitchens shall contain ammonium stearate, or aluminum tri-stearate, or calcium stearate in an amount equal to 3 percent by weight of cement used. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

2.10.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494, Type C.

2.11 GROUT

Grout shall conform to ASTM C 476. Cement used in grout shall have a low alkali content. Grout slump shall be between 8 and 10 inches. Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements.

2.11.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494, Type C.

2.11.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

2.12.1 Wire Mesh Ties

Wire mesh for tying 4 inch thick concrete masonry unit partitions to other intersecting masonry partitions shall be 1/2 inch mesh of minimum 16 gauge steel wire. Minimum lengths shall be not less than (12 inches).

2.12.4 Adjustable Anchors

Adjustable anchors shall be 3/16 inch diameter steel wire, triangular-shaped. Anchors attached to steel shall be 5/16 inch diameter steel bars placed to provide 1/16 inch play between flexible anchors and structural steel members. Spacers shall be welded to rods and columns. Equivalent welded-on steel anchor rods or shapes standard with the flexible-anchor manufacturer may be furnished when approved. Welds shall be cleaned and given one coat of zinc-rich touch up paint.

2.12.5 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

2.13 JOINT REINFORCEMENT

Joint reinforcement shall be factory fabricated from steel wire conforming to ASTM A 82, welded construction. Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A 153, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of (5/8 inch) cover from either face. The distance between crosswires shall not exceed 16 inches. Joint reinforcement for straight runs shall be furnished in flat sections not less than 10 feet long. Joint reinforcement shall be provided with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features.

2.14 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A 615, Grade 60.

2.15 CONTROL JOINT KEYS

Control joint keys shall be a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D 2000 or polyvinyl chloride conforming to ASTM D 2287. The material shall be resistant to oils and solvents. The control joint key shall be provided with a solid shear section not less than 5/8 inch thick and 3/8 inch thick flanges, with a tolerance of plus or minus 1/16 inch. The control joint key shall fit neatly, but without forcing, in masonry unit jamb sash grooves. The control joint key shall be flexible at a temperature of minus 30 degrees F after five hours exposure, and shall have a durometer hardness of not less than 70 when tested in accordance with ASTM D 2240.

2.16 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section 07920 JOINT SEALING.

2.18 FLASHING

Flashing shall be as specified in Section 07600 SHEET METALWORK, GENERAL.

2.19 WEEP HOLE VENTILATORS

Weephole ventilators shall be prefabricated aluminum grill type vents designed to prevent insect entry with maximum air entry. Ventilators shall be sized to match modular construction with a standard 3/8 inch mortar joint.

PART 3 EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

3.1.1 Hot Weather Installation

The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 99 degrees F in the shade and the relative humidity is less than 50 percent. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 4 feet ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

3.1.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below (40 degrees F), a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection.

3.1.2.1 Preparation

Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

- a. Air Temperature (40 to 32 Degrees F). Sand or mixing water shall be heated to produce mortar temperatures between (40 degrees F and 120 degrees F).
- b. Air Temperature (32 to 25 Degrees F). Sand and mixing water shall be heated to produce mortar temperatures between (40 degrees F and 120 degrees F). Temperature of mortar on boards shall be maintained above freezing.
- c. Air Temperature (25 to 20 Degrees F). Sand and mixing water shall be heated to provide mortar temperatures between (40 degrees F and 120 degrees F). Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of (15 mph).
- d. Air Temperature (20 Degrees F) and below. Sand and mixing water shall be heated to provide mortar temperatures between (40 degrees F and 120 degrees F). Enclosure and auxiliary heat shall be provided to maintain air temperature above (32 degrees F).

Temperature of units when laid shall not be less than (20 degrees F.)

3.1.2.2 Completed Masonry and Masonry Not Being Worked On

- a. Mean daily air temperature (40 degrees F to 32 degrees F). Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.
- b. Mean daily air temperature (32 degrees F to 25 degrees F) Masonry shall be completely covered with weather-resistant membrane for 24 hours.
- c. Mean Daily Air Temperature (25 Degrees F to 20 Degrees F). Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.
- d. Mean Daily Temperature (20 Degrees F) and Below. Masonry temperature shall be maintained above (32 degrees F) for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

3.2 LAYING MASONRY UNITS

Masonry units shall be laid in running bond pattern. Facing courses shall be level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances shall be plus or minus (1/2 inch). Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be free from chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Mortar for veneer wythes shall be beveled and sloped toward the center of the wythe from the cavity side. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of brick and the vertical face shells of concrete masonry units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to (1/2 inch) into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below. In double wythe stone construction, the inner wythe may be brought up not more than (16 inches) ahead of the outer wythe. Collar joints shall be filled with mortar or grout after the laying of both wythe, and placement of collar joint reinforcement.

3.2.1 Surface Preparation

Surfaces upon which masonry is placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least 1/8 inch. Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

3.2.2 Forms and Shores

Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

3.2.3 Concrete Masonry Units

Units in piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Foundation walls below grade shall be grouted solid. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved. Double walls shall be stiffened at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of the double wall. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

3.2.4 Clay or Shale Brick Units

3.2.4.1 Wetting of Units

Wetting of clay, shale brick, or hollow brick units having an initial rate of absorption of more than 1 gram per minute per square inch of bed surface shall be in conformance with ASTM C 67. The method of wetting shall ensure that each unit is nearly saturated but surface dry when laid.

3.2.4.2 Solid Units

Bed, head, and collar joints shall be completely filled with mortar.

3.2.4.3 Hollow Units

Hollow units shall be laid as specified for concrete masonry units.

3.2.5 Tolerances

Masonry shall be laid plumb, true to line, with courses level. Bond pattern shall be kept plumb throughout. Corners shall be square unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, masonry shall be laid within the following tolerances (plus or minus unless otherwise noted):

TABLE II

TOLERANCES

Variation from the plumb in the lines
and surfaces of columns, walls and arises

In adjacent masonry units

1/8 inch

TOLERANCES

In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch

Variations from the plumb for external corners, expansion joints, and other conspicuous lines

In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

Variations from the level for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines

In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

Variation from level for bed joints and top surfaces of bearing walls

In 10 feet	1/4 inch
In 40 feet or more	1/2 inch

Variations from horizontal lines

In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch

Variations in cross sectional dimensions of columns and in thickness of walls

Minus	1/4 inch
Plus	1/2 inch

3.2.6 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

3.2.7 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

3.2.7.1 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight. Flush joints for architectural units, such as fluted units, shall completely fill both the head and bed joints.

3.2.7.2 Tooled Joints

Joints in exposed exterior and interior masonry surfaces shall be tooled to match existing construction. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

3.2.7.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch.

3.2.8 Joint Widths

Joint widths shall be as follows:

3.2.8.1 Concrete Masonry Units

Concrete masonry units shall have 3/8 inch joints, except for prefaced concrete masonry units.

3.2.8.3 Stone

Stone joint widths shall be the same as referenced existing walls.

3.2.9 Embedded Items

Spaces around built-in items shall be filled with mortar. Openings around flush-mount electrical outlet boxes in wet locations shall be pointed with mortar. Anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in shall be embedded as the masonry work progresses. Anchors, ties and joint reinforcement shall be fully embedded in the mortar. Cells receiving anchor bolts and cells of the first course below bearing plates shall be filled with grout.

3.2.10 Unfinished Work

Unfinished work shall be stepped back for joining with new work. Toothing

may be resorted to only when specifically approved. Loose mortar shall be removed and the exposed joints shall be thoroughly cleaned before laying new work.

3.2.11 Masonry Wall Intersections

Each course shall be masonry bonded at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

3.2.12 Partitions

Partitions shall be continuous from floor to underside of floor or roof deck where shown. Where suspended ceilings on both sides of partitions are indicated, the partitions other than those shown to be continuous may be stopped approximately 4 inches above the ceiling level. An isolation joint shall be placed in the intersection between partitions and structural or exterior walls as shown. Interior partitions having 4 inch nominal thick units shall be tied to intersecting partitions of 4 inch units, 5 inches into partitions of 6 inch units, and 7 inches into partitions of 8 inch or thicker units. Cells within vertical plane of ties shall be filled solid with grout for full height of partition or solid masonry units may be used. Interior partitions having masonry walls over 4 inches thick shall be tied together with joint reinforcement. Partitions containing joint reinforcement shall be provided with prefabricated pieces at corners and intersections or partitions.

3.4 WEEP HOLES

Weep holes shall be provided not more than 24 inches on centers in mortar joints of the exterior wythe above wall flashing, over foundations, bond beams, and any other horizontal interruptions of the cavity. Weep holes shall be constructed using weep hole ventilators. Other approved methods may be used for providing weep holes. Weep holes shall be kept free of mortar and other obstructions.

3.9 MORTAR

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours after mixing shall be discarded.

3.10 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 2 inches of tops of walls.

3.10.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 1/2 inch shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

3.10.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

3.11 JOINT REINFORCEMENT

Joint reinforcement shall be installed at 16 inches on center or as indicated. Reinforcement shall be lapped not less than 6 inches. Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 5/8 inch cover to either face of the unit.

3.12 PLACING GROUT

Cells containing reinforcing bars shall be filled with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Cells under lintel bearings on each side of openings shall be filled solid with grout for full height of openings. Walls below grade, lintels, and bond beams shall be filled solid with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

3.12.2 Horizontal Grout Barriers

Grout barriers shall be embedded in mortar below cells of hollow units receiving grout.

3.12.3 Grout Holes and Cleanouts

3.12.3.1 Grout Holes

Grouting holes shall be provided in slabs, spandrel beams, and other in-place overhead construction. Holes shall be located over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Additional openings spaced not more than 16 inches on centers shall be provided where grouting of all hollow unit masonry is indicated. Openings shall not be less than 4 inches in diameter or 3 by 4 inches in

horizontal dimensions. Upon completion of grouting operations, grouting holes shall be plugged and finished to match surrounding surfaces.

3.12.3.2 Cleanouts for Hollow Unit Masonry Construction

Cleanout holes shall be provided at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet. Where all cells are to be grouted, cleanout courses shall be constructed using bond beam units in an inverted position to permit cleaning of all cells. Cleanout holes shall be provided at a maximum spacing of 32 inches where all cells are to be filled with grout. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 3 by 4 inch openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

3.12.3.3 Cleanouts for Solid Unit Masonry Construction

Cleanouts for construction of walls consisting of a grout filled cavity between solid masonry wythes shall be provided at the bottom of every pour by omitting every other masonry unit from one wythe. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanout holes shall not be plugged until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

3.12.4 Grouting Equipment

3.12.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Pumps shall be operated to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, waste materials and debris shall be removed from the equipment, and disposed of outside the masonry.

3.12.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. At least one spare vibrator shall be maintained at the site at all times. Vibrators shall be applied at uniformly spaced points not further apart than the visible effectiveness of the machine. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing segregation.

3.12.5 Grout Placement

Masonry shall be laid to the top of a pour before placing grout. Grout shall not be placed in two-wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using

a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 5 feet in height. High-lift grout methods shall be used on pours exceeding 5 feet in height.

3.12.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 1/2 inch into the grout space shall be removed before beginning the grouting operation. Grout pours 12 inches or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 12 inches in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

3.12.5.2 High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than 1/4 inch into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses. Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in the grout space shall be placed as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to 4 feet in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 12 to 18 inches into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2)
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TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum Grout Pour Height (feet) (4)	Grout Type	Grouting Procedure	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2)	
			Multiwythe Masonry (3)	Hollow-unit Masonry
Grout Pour Height (feet) (4)	Grout Type	Grouting Procedure	Multiwythe Masonry (3)	Hollow-unit Masonry
1	Fine	Low Lift	3/4	1-1/2 x 2
5	Fine	Low Lift	2	2 x 3
8	Fine	High Lift	2	2 x 3
12	Fine	High Lift	2-1/2	2-1/2 x 3
24	Fine	High Lift	3	3 x 3
1	Coarse	Low Lift	1-1/2	1-1/2 x 3
5	Coarse	Low Lift	2	2-1/2 x 3
8	Coarse	High Lift	2	3 x 3
12	Coarse	High Lift	2-1/2	3 x 3
24	Coarse	High Lift	3	3 x 4

Notes:

- (1) The actual grout space or cell dimension must be larger than the sum of the following items:
 - a) The required minimum dimensions of total clear areas given in the table above;
 - b) The width of any mortar projections within the space;
 - c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.
- (2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 3/4 inch or greater in width.
- (3) For grouting spaces between masonry wythes.
- (4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

3.13 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 1/2 inch shall be maintained between reinforcement and interior faces of units.

3.14 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by using special control-joint units in accordance with the details shown on the drawings. Sash jamb units shall have a 3/4 by 3/4 inch groove near the center at end of each unit. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. In single wythe exterior masonry walls, the exterior control joints shall be raked to a depth of 3/4 inch; backer rod and sealant shall be installed in accordance with Section 07920 JOINT SEALING. Exposed interior control joints shall be raked to a depth of 1/4 inch. Concealed control joints shall be flush cut.

3.17 LINTELS

3.17.1 Masonry Lintels

Masonry lintels shall be constructed with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 4 bars in the bottom course unless otherwise indicated on the drawings. Lintel reinforcement shall extend beyond each side of masonry opening 40 bar diameters or 24 inches, whichever is greater. Reinforcing bars shall be supported in place prior to grouting and shall be located 1/2 inch above the bottom inside surface of the lintel unit.

3.17.2 Precast Concrete and Steel Lintels

Precast concrete and steel lintels shall be as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true. Steel and precast lintels shall have a minimum bearing length of 8 inches unless otherwise indicated on the drawings.

3.18 SILLS AND COPINGS

Sills and copings shall be set in a full bed of mortar with faces plumb and true.

3.19 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL

3.19.1 Anchorage to Concrete Where Occurs

Anchorage of masonry to the face of concrete columns, beams, or walls shall be with dovetail anchors spaced not over 16 inches on centers vertically and 24 inches on center horizontally.

3.19.2 Anchorage to Structural Steel Where Occurs

Masonry shall be anchored to vertical structural steel framing with adjustable steel wire anchors spaced not over 16 inches on centers vertically, and if applicable, not over 24 inches on centers horizontally.

3.22 SPLASH BLOCKS

Splash blocks shall be located as shown.

3.23 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, mortar and grout daubs or splashes shall be completely removed from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

3.23.1 Concrete Masonry Unit and Stone Surfaces

Exposed masonry unit surfaces shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.24 BEARING PLATES

Bearing plates for beams, joists, joist girders and similar structural members shall be set to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated. Bedding mortar and non-shrink grout shall be as specified in Section 03300CAST-IN-PLACE STRUCTURAL CONCRETE.

3.25 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet

system. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

3.26 TEST REPORTS

3.26.1 Field Testing of Mortar

At least three specimens of mortar shall be taken each day. A layer of mortar 1/2 to 5/8 inch thick shall be spread on the masonry units and allowed to stand for one minute. The specimens shall then be prepared and tested for compressive strength in accordance with ASTM C 780.

3.26.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C 1019. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 2000 psi at 28 days.

3.26.4 Prism Tests

At least one prism test sample shall be made for each 5,000 square feet of wall but not less than two such samples shall be made for any building. Three prisms shall be used in each sample. Prisms shall be tested in accordance with ASTM E 447. Seven-day tests may be used provided the relationship between the 7- and 28-day strengths of the masonry is established by the tests of the materials used. Compressive strength shall not be less than 2000 psi at 28 days. If the compressive strength of any prism falls below the specified value by more than 500 psi, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. If the likelihood of low-strength masonry is confirmed and computations indicate that the load-carrying capacity may have been significantly reduced, tests of cores drilled, or prisms sawed, from the area in question may be required. In such case, three specimens shall be taken for each prism test more than 500 psi below the specified value. Masonry in the area in question shall be considered structurally adequate if the average compressive strength of three specimens is equal to at least 85 percent of the specified value, and if the compressive strength of no single specimen is less than 75 percent of the specified value. Additional testing of specimens extracted from locations represented by erratic core or prism strength test results shall be permitted.

-- End of Section --

SECTION 05500

MISCELLANEOUS METAL
07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1980; R 1993) Designation System
for Aluminum Finishes

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A14.3 (1992) Ladders - Fixed - Safety
Requirements
ANSI MH28.1 (1982) Design, Testing, Utilization,
and Application of Industrial Grade Steel
Shelving

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36 (1996) Carbon Structural Steel
ASTM A 53 (1996) Pipe, Steel, Black and Hot-
Dipped, Zinc-Coated, Welded and Seamless
ASTM A 123 (1989a) Zinc (Hot-Dip Galvanized)
Coatings on Iron and Steel Products
ASTM A 283 (1993a) Low and Intermediate Tensile
Strength Carbon Steel Plates
ASTM A 467 (1993) Machine and Coil Chain
ASTM A 475 (1995) Zinc-Coated Steel Wire Strand

ASTM A 500 (1993) Cold-Formed Welded and Seamless
Carbon Steel Structural Tubing in Rounds
and Shapes
ASTM A 653 (1996) Steel Sheet, Zinc-Coated
(Galvanized) or Zinc-Iron Alloy-Coated
(Galvannealed) by the Hot-Dip Process
ASTM A 924 (1996a) Steel Sheet, Metallic-Coated by
the Hot-Dip Process
ASTM B 26 (1996a) Aluminum-Alloy Sand Castings
ASTM B 221 (1996) Aluminum and Aluminum-Alloy
Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM B 429 (1995) Aluminum-Alloy Extruded Structural
Pipe and Tube
ASTM D 2047 (1993) Static Coefficient of Friction of
Polish-Coated Floor Surfaces as Measured by
the James Machine
ASTM F 1267 (1991) Metal, Expanded, Steel

AMERICAN SOCIETY FOR CIVIL ENGINEERS (ASCE)

ASCE 7 (1995) Minimum Design Loads for Buildings and Other Structures

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (1994) Structural Welding Code - Steel

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-344 (Rev B) Lacquer, Clear Gloss, Exterior, Interior

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531 (1993) Metal Bar Grating Manual
NAAMM MBG 532 (1988) Heavy Duty Metal Bar Grating Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211 (1992) Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 SD Drawing

Miscellaneous Metal Items; GA

Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates. Detail drawings for the following items

1.3 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123, ASTM A 653, or ASTM A 924, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

1.4 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

1.5 WORKMANSHIP

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

1.6 ANCHORAGE

Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

1.7 ALUMINUM FINISHES

Unless otherwise specified, aluminum items shall have standard mill finish. The thickness of the coating shall be not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF-45. Items to be anodized shall receive a polished satin finish. Aluminum surfaces to be in contact with plaster or concrete during construction shall be protected with a field coat conforming to CID A-A-344.

1.8 SHOP PAINTING

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

PART 2 PRODUCT

2.1 CORNER GUARDS AND SHIELDS

Corner guards and shields for jambs and sills of openings and edges of platforms as shown shall be steel shapes and plates anchored in masonry

or concrete with welded steel straps or end weld stud anchors. Corner guards for use with glazed or ceramic tile finish on walls shall be formed of 1.6 mm (0.0625 inch) thick corrosion-resisting steel with polished or satin finish, shall extend 1.5 m (5 feet) above the top of cove base or to the top of the wainscot, whichever is less, and shall be securely anchored to the supporting wall. Corner guards on exterior shall be galvanized.

2.2 DOOR GUARDS

Door guards shall be constructed of woven steel wire or expanded metal framed with structural steel shapes. Expanded metal guards shall be of 38 mm (1-1/2 inch) No. 10 mesh, welded to 25 by 25 by 3 mm (1 by 1 by 1/8 inch) angle frame. Woven-wire panel shall be of 10 gauge, 38 mm (1-1/2 inch) mesh secured through weaving to 25 mm (1 inch) channel frame or around a 10 mm (3/8 inch) round bar frame. Corners of frames shall be mitered and welded. Guards shall be sized as indicated.

2.3 PIPE GUARDS

Pipe guards shall be heavy duty steel pipe conforming to ASTM A 53, Type E or S, weight STD, black finish.

2.4 DOWNSPOUT BOOTS

Downspout boots shall be cast iron with receiving bells sized to fit downspouts.

2.5 FLOOR GRATINGS AND FRAMES

Carbon steel grating shall be designed in accordance with NAAMM MBG 531, NAAMM MBG 532 to meet the indicated load requirements. Edges shall be banded with bars 6 mm (1/4 inch) less in height than bearing bars for grating sizes above 19 mm. (3/4 inch.) Banding bars shall be flush with the top of bearing grating. Frames shall be of welded steel construction finished to match the grating. Floor gratings and frames shall be galvanized after fabrication.

2.6 FLOOR PLATES

Floor plates shall be 6 mm (1/4 inch) thick, galvanized.

2.7 LADDERS

Ladders shall be galvanized steel or aluminum, fixed rail type in accordance with ANSI A14.3.

2.8 MISCELLANEOUS

Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings, and frames, shall be provided to complete the work.

2.9 CHAINS

Safety and blast door operation chains shall be galvanized welded steel, proof coil chain tested in accordance with ASTM A 467, Class CS.

Safety chains shall be straight link style, 5 mm (3/16 inch) diameter, minimum 39 links per meter (12 links per foot) and with bolt type snap hooks on each end. Eye bolts for attachment of chains shall be galvanized 10 mm (3/8 inch) bolt with 19 mm (3/4 inch) eye, anchored as indicated. Two chains shall be furnished for each guarded opening.

2.10 SAFETY NOSING

Safety nosings shall be of cast iron with cross-hatched], abrasive surface. Nosing shall be 75 mm (3 inches) wide and terminating at not more than 150 mm (6 inches) from the ends of treads, except nosing for metal pan cement-filled treads shall extend the full length of the tread. Safety nosings shall be provided with anchors not less than 19 mm (3/4 inch) long. Integrally cast mushroom anchors are not acceptable.

2.11 STEEL DOOR FRAMES

Steel door frames built from structural shapes shall be neatly mitered and securely welded at the corners with all welds ground smooth. Jambs shall be provided with 50 by 6 by 300 mm (2 by 1/4 by 12 inch) bent, adjustable metal anchors spaced not over 760 mm (2 feet 6 inches) on centers. Provision shall be made to stiffen the top member for all spans over 900 mm. (3 feet.) Continuous door stops shall be made of 38 by 16 mm (1-1/2 by 5/8 inch) bars.

2.12 WINDOW GUARDS, BAR GRILLE TYPE

Bar grill window guards shall be of 19 mm (3/4 inch) round bars, spaced not over 100 mm (4 inches) on centers vertically, and 50 by 13 mm (2 by 1/2 inch) horizontal bars spaced not over 300 mm (12 inches) on centers. Vertical bars shall be extended through and securely welded to the cross bars. Horizontal bars shall be extended, bent, and drilled as shown for anchorage at jambs of window openings.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Items listed below require additional procedures as specified.

3.2 REMOVABLE ACCESS PANELS

A removable access panel not less than 300 by 300 mm (12 by 12 inches) shall be installed directly below each valve, flow indicator, damper, or air splitter that is located above the ceiling, other than an acoustical ceiling, and that would otherwise not be accessible.

3.3 INSTALLATION OF PIPE GUARDS

Pipe guards shall be set vertically in concrete piers. Piers shall be constructed of, and the hollow cores of the pipe filled with, concrete specified in SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.4 INSTALLATION OF SAFETY NOSINGS

Nosing shall be completely embedded in concrete before the initial set of the concrete occurs and shall finish flush with the top of the concrete surface.

3.5 DOOR FRAMES

Door frames shall be secured to the floor slab by means of angle clips and expansion bolts. Continuous door stops shall be welded to the frame or tap screwed with countersunk screws at no more than 450 mm (18 inch) centers, assuring in either case full contact with the frame. Any necessary reinforcements shall be made and the frames shall be drilled and tapped as required for hardware.

-- End of Section --</body>

SECTION 06100

ROUGH CARPENTRY

07/98 [AMEND 0001]

PART 1 GENRAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN FOREST AND PAPER ASSOCIATION (AFPA)

AFPA-T901	(1991; Supple 1993; Addenda Apr 95) National Design Specification for Wood Construction
AFPA T11-WCD1	(1988) Manual for Wood Frame Construction

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4	(1995) Basic Hardboard
AHA A194.1	(1985) Cellulosic Fiberboard

AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)

AITC-01	(1994) Timber Construction Manual
AITC 109	(1990) Standard for Preservative Treatment of Structural Glued Laminated Timber
AITC 111	(1979) Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection
AITC-190.1	(1992) Wood Products - Structural Glued Laminated Timber

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A208.1	(1993) Particleboard
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APA-THE ENGINEERED WOOD ASSOCIATION (APA)

APA Form E30	(1996) Design/Construction Guide, Residential and Commercial
APA E445	(1991; Rev Jan 1996) Performance Standards and Policies for Structural-Use Panels
APA Form E30	(1996) Design/Construction Guide, Residential and Commercial
APA E445	(1991; Rev Jan 1996) Performance Standards and Policies for Structural-Use Panels
APA EWS R540	(1996) Proper Storage and Handling of

APA EWS T300
APA V450

Glulam Beams
(1997)Glulam Connection Details
(1994; Rev Apr 1996) Source List -
Adhesives for APA Glued Floor System

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM C 79	(1994) Gypsum Sheathing Board
ASTM C 208	(1995) Cellulosic Fiber Insulating Board
ASTM C 516	(1980; R 1990) Vermiculite Loose Fill Thermal Insulation
ASTM C 518	(1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties By Means of the Heat Flow Meter Apparatus
ASTM C 549	(1981; R 1995) Perlite Loose Fill Insulation
ASTM C 552	(1991) Cellular Glass Thermal Insulation
ASTM C 553	(1992) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(1994) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
STM C 612	(1993) Mineral Fiber Block and Board Therml Insulation
ASTM C 665	(1994) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
ASTM C 726	(1993) Mineral Fiber Roof Insulation Board
ASTM C 739	(1991) Cellulosic Fiber (Wood-Base) Loose-Fill Thermal Insulation
ASTM C 764	(1994) Mineral Fiber Loose-Fill Thermal Insulation
ASTM C 1013	(1994) Faced Rigid Cellular Polyisocyanurate Roof Insulation
ASTM C 1136	(1992) Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C 1289	(1995) Faced Rigid Cellular
ASTM D 2898	(1994) Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
ASTM E 84	(1996a)Surface Burning Characteristics of Building Materials
ASTM E 96	(1995) Water Vapor Transmission of Materials
ASTM E 154	(1988; R 1993) Water Vapor Retarders Used in Contact with Earth Under Concrete

Slabs, on Walls, or as Ground Cover

ASTM F 547

(1995) Water Vapor Transmission of
Materials

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C2

(1995) Lumber, Timber, Bridge Ties and
Mine Ties - Preservative Treatment by
Pressure Processes

AWPA C9

(1995) Plywood - Preservative Treatment
by Pressure Processes

AWPA C20

(1993) Structural Lumber Fire-Retardant
Pressure Treatment

AWPA C27

(1993) Plywood - Fire-Retardant Pressure
Treatment

AWPA M4

(1995) Standard for the Care of
Preservative-Treated Wood Products

AWPA P5

(1996) Standards for Waterborne
Preservatives

CALIFORNIA REDWOOD ASSOCIATION (CRA)

CRA-01

(1995) Standard Specifications for Grades
of California Redwood Lumber

CODE OF FEDERAL REGULATION (CFR)

CFR 1209

(1995) Interim Safety Standard for Cellulose

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1

(1996) Voluntary Product Standard -
Construction and Industrial Plywood

DOC PS 2

(1992) Performance Standards for
Wood-Based Structural-Use Panels

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825

(1997) Approval Guide Building
Materials

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA-01

(1994) Rules for the Measurement
Inspection of Hardwood Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA-01

(1993) Standard Grading Rules for
Northeastern Lumber

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA-01 (1986; Supple No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB-1001 (1994) Standard Grading Rules for Southern Pine Lumber

TRUSS PLATE INSTITUTE (TPI)

SPIB-1001 (1995) National Design Standard for Metal Plate-Connected Wood Truss Construction and Commentary and Appendices to TPI 1

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17 (1993) amp;Supples III (A), V (A),VI (A)Grading Rules for West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA-01WCLIB (1995; Supple Nos. 1, 2, and 3) Western Lumber Grading Rules 95

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

Nailers and Nailing Strips; FIO

Drawings of field erection details, including materials and methods of fastening nailers in conformance with Factory Mutual wind uplift rated systems specified in other Sections of these specifications.

SD-13 SD Certificates

Grading and Marking; FIO

Manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material not normally grade marked meet the specified requirements. Certificate of Inspection for grade marked material by an American Lumber Standards Committee (ALSC) recognized inspection agency prior to shipment.

SD-13 SD Certificates

Insulation; FIO

Certificate attesting that the cellulose, perlite, glass and mineral fiber, polyurethane, or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such

recovered material.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity. Laminated timber shall be handled and stored in accordance with AITC 111 or APA EWS R540

PART 2 PRODUCT

2.1 LUMBER AND SHEATHING

2.1.1 Grading and Marking

2.1.1.1 Lumber Products

Solid sawn and finger-jointed lumber shall bear an authorized gradestamp or grademark recognized by ALSC, or an ALSC recognized certification stamp, mark, or hammerbrand. Surfaces that are to be exposed to view shall not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

2.1.1.2 Plywood and other Sheathing Products

Materials shall bear the grademark or other identifying marks indicating grades of material and rules or standards under which produced, including requirements for qualifications and authority of the inspection organization. Except for plywood and structural-use panels, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be exposed to view shall not bear grademarks or other types of identifying marks.

2.1.2 Sizes

Lumber and material sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Unless otherwise specified, sizes indicated are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Treatment

Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPA M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil. Except as specified for all-heart material of the previously mentioned species, the following items shall be treated:

- a. Wood members in contact with or within 455 mm (18 inches) of soil.
- b. Wood members in contact with water
- c. Wood members exposed to the weather including those used in builtup roofing systems or as nailing strips or nailers over fiberboard or gypsum-board wall sheathing as a base for wood siding.

- d. Wood members set into concrete regardless of location, including flush-with-deck wood nailers for roofs.
- e. Wood members in contact with concrete that is in contact with soil or water or that is exposed to weather.

2.1.3.1 Lumber and Timbers

Lumber and timbers shall be treated in accordance with AWPAC2 with waterborne preservatives listed in AWPAC5 to a retention level as follows:

- a. 4 kg per cubic meter (0.25 pcf) intended for above ground use.
- b. 6.4 kg per cubic meter (0.40 pcf) intended for ground contact and fresh water use.

2.1.3.2 Plywood

Plywood shall be treated in accordance with AWPAC9 with waterborne preservatives listed in AWPAC5 to a retention level as follows:

- a. 4 kg per cubic meter (0.25 pcf) intended for above ground use.
- b. 6.4 kg per cubic meter (0.40 pcf) intended for ground contact and fresh water use.

2.1.4 Moisture Content

At the time lumber and other materials are delivered and when installed in the work their moisture content shall be as follows:

- a. Treated and Untreated Lumber Except Roof Planking: 100 mm (4 inches) or less, nominal thickness, 19 percent maximum. 125 mm (5 inches) or more, nominal thickness, 23 percent maximum in a 75 mm (3 inch) perimeter of the timber cross-section.
- b. Roof Planking: 15 percent maximum.
- c. Materials Other Than Lumber: In accordance with standard under which product is produced.

2.1.5 Miscellaneous Wood Members

2.1.5.1 Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

Member	Size mm (inch)
Bridging	25 x 75 (1 x 3) or 25 x 100 (1 x 4)
for use between members 50 x 300 (2 x 12) and smaller;	
50 x 100 (2 x 4)	
for use between members larger than 50 x 300 (2 x 12)	
Corner bracing	25 x 100 (1 x 4)

Furring	25 (1) x 50 (2)
Grounds	Plaster thickness by 38.
Nailing strips	25 x 75 (1 x 3) or 25 x 100 (1 x 4)

when used as shingle base or interior finish, otherwise 50 mm (2 inch) stock.

Member	Size (inch)
Bridging	1 x 3 or 1 x 4 for use between members 2 x 12 and smaller; 2 x 4 for use between members larger than 2 x 12.
Corner bracing	1 x 4.
Furring	1 x 2
Nailing strips	1 x 3 or 1 x 4 when used as shingle base or interior finish, otherwise 2 inch stock.

2.1.5.2 Wood Bumpers

Bumpers shall be of the species and grade in accordance with TABLE II at the end of this section, size as shown.

2.1.5.3 Sill Plates

Sill plates shall be standard or number 2 grade.

2.1.5.4 Blocking

Blocking shall be standard or number 2 grade

2.1.5.5 Rough Bucks and Frames

Rough bucks and frames shall be straight standard or number 2 grade.

2.2 ACCESSORIES AND NAILS

Markings shall identify both the strength grade and the manufacturer. Accessories and nails shall conform to the following

2.2.1 Anchor Bolts

ASTM A 307, size as indicated, complete with nuts and washers.

2.2.2 Bolts: Lag, Toggle, and Miscellaneous

Bolts and Screws Type, size, and finish best suited for intended use. Finish options include zinc compounds, cadmium, and aluminum paint impregnated finishes.

2.2.3 Clip Angles

Steel, 5 mm (3/16 inch) thick, size best suited for

intended use; or zinc-coated steel or iron commercial clips designed for connecting wood members.

2.2.4 Expansion Shields

Type and size best suited for intended use.

2.2.5 Nails and Staples

ASTM F 547, size and type best suited for purpose; staples shall be as recommended by the manufacturer of the materials to be joined. In general, 8-penny or larger nails shall be used for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber; 16-penny or larger nails shall be used for nailing through 50 mm (2 inch) thick lumber. Nails used with treated lumber and sheathing shall be galvanized. Nailing shall be in accordance with the recommended nailing schedule contained in AFPA T11-WCD1. Where detailed nailing requirements are not specified, nail size and spacing shall be sufficient to develop an adequate strength for the connection. The connection's strength shall be verified against the nail capacity tables in AFPA-T901. Reasonable judgement backed by experience shall ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector shall be used.

2.3 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown. R-values shall be determined at 24 degrees C 75 degrees F in accordance with ASTM C 518. Insulation shall contain the highest practicable percentage of recovered material which has been recovered or diverted from solid waste, but not including material reused in a manufacturing process. Where two materials have the same price and performance, the one containing the higher recovered material content shall be provided. Insulation shall be the standard product of a manufacturer and factory marked or identified with manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Materials containing more than one percent asbestos will not be allowed.

2.3.1 Batt or Blanket

2.3.1.1 Mineral Fiber Batt

Mineral fiber batt shall conform to ASTM C 665 Type II kraft faced insulation, Class C .

2.3.1.2 Mineral Fiber Blanket

Mineral fiber blanket shall conform to ASTM C 553, Type I, Class 6. Blankets shall be sized to suit construction conditions, resilient type for use below and above ambient temperature to 195 degrees C. 350 degrees F. Blankets shall have a factory applied vapor-barrier facing on one side with 50 mm (2 inch) nailing tabs on both edges. Vapor barriers shall be fire retardant, high vapor transmission, and aluminum foil laminated to crepe paper type conforming to ASTM C 1136, Type II. Nominal density shall be 12 kg per cubic meter

(0.75 pcf).

2.3.2 Loose Fill or Granular Fill

2.3.2.1 Vermiculite

Vermiculite shall conform to ASTM C 516, Type II.

2.3.2.2 Perlite

Perlite shall conform to ASTM C 549, Type II with minimum recovered material content of 23 percent by weight of core material.

2.3.3 Rigid Insulation

2.3.3.1 Polystyrene Board

Polystyrene board shall be extruded and conform to ASTM C 578, Type IV.

2.3.3.2 Polyurethane or Polyisocyanurate Board

Polyurethane or polyisocyanurate board shall conform to ASTM C 1013(having a minimum recovered material content of 9 percent by weight of core material in the polyurethane or polyisocyanurate portion).Unfaced preformed polyurethane shall conform to ASTM C 591 Faced polyisocyanurate shall conform to ASTM C 1289

2.3.3.3 Glass Fiber or Insulation Board

Glass fiber or insulation board shall conform to ASTM C 612 Type 1A with a minimum recovered material content of 6 percent by weight of glass fiber core material.

2.3.3.5 Cellular Glass

Cellular glass shall conform to ASTM C 552

2.4 VAPOR RETARDER

Vapor retarder shall be polyethylene sheeting conforming to ASTM E 154 or other equivalent material. Vapor retarder shall have a maximum vapor permeance rating of 29 ng per Pa per second per square meter 0.5 perms as determined in accordance with ASTM E 96, unless otherwise specified.

PART 3 EXECUTION

3.1 INSTALLATION OF FRAMING

3.1.1 General

Members shall be closely fitted, accurately set to required lines and levels, and rigidly secured in place. Members shall be framed for passage

of ducts. Members shall be cut, notched, or bored in accordance with applicable requirements of AFPA-T901 for the passage of pipes, wires, or conduits.

3.2 INSTALLATION OF SHEATHING

3.2.1 Gypsum Board

Sheathing shall be applied with edges in light contact at joints and nailed in accordance with the manufacturer's approved instructions. Sheets 600 mm (2 feet) wide shall be applied horizontally with tongued edge up, with vertical joints over supports, and with vertical joints staggered. Sheets 1200 mm (4 feet) wide shall be applied vertically, extended over top and bottom plates, and with all vertical and horizontal joints over supports

3.3 INSTALLATION OF MISCELLANEOUS WOOD MEMBERS

3.3.1 Blocking

Blocking shall be provided as necessary for application of siding, sheathing, subflooring, wallboard, and other materials or building items, and to provide firestopping. Blocking for firestopping shall ensure a maximum dimension of 2400 mm (8 feet) for any concealed space. Blocking shall be cut to fit between framing members and rigidly nailed thereto.

3.3.2 Nailers and Nailing Strips

Nailers and nailing strips shall be provided as necessary for the attachment of finish materials. Stacked nailers shall be assembled with spikes or nails spaced not more than 450 mm (18 inches) on center and staggered. Beginning and ending nails shall not be more than 150 mm 6 inches for nailer end. Ends of stacked nailers shall be offset approximately 300 mm 12 inches in long runs and alternated at corners. Anchors shall extend through the entire thickness of the nailer. Strips shall be run in lengths as long as practicable, butt jointed, cut into wood framing members when necessary, and rigidly secured in place. Nailers and nailer installation for Factory Mutual wind uplift rated roof systems specified in other Sections of these specifications shall conform to FM P7825c.

3.3.3 Furring Strips

Furring strips shall be provided at the locations shown. Furring strips shall be installed at 400 mm (16 inches) on center unless otherwise shown, run in lengths as long as practicable, butt jointed and rigidly secured in place.

3.3.4 Wood Bumpers

Wood bumpers shall be bored, countersunk and securely bolted in place.

3.4 INSTALLATION OF INSULATION

Insulation shall be installed after construction has advanced to a point that the installed insulation will not be damaged by remaining work. For

thermal insulation the actual installed thickness shall provide the thermal resistance R-values shown. For acoustical insulation the installed thickness shall be as shown. Insulation shall be installed on the weather side of such items as electrical boxes and water lines. Unless otherwise specified, installation shall be in accordance with the manufacturer's recommendation.

3.5 INSTALLATION OF VAPOR RETARDER

Vapor retarder shall be applied to provide a continuous barrier at window and door frames, and at all penetrations such as electrical outlets and switches, plumbing connections, and utility service penetrations. Joints in the vapor retarder shall be lapped and sealed according to the manufacturer's recommendations.

3.6 INSTALLATION OF AIR INFILTRATION BARRIER

Air infiltration barrier shall be installed in accordance with the manufacturer's recommendations.

TABLE I. SPECIES AND GRADE

Subflooring, Roof Sheathing, Wall Sheathing, Furring

Grading Rules	Species	Const Standard	No. 2 Comm	No. 2 Board Comm	No. 3 Comm
NHLA-01					
Cypress			X		
NELMA-01					
Northern White Cedar				X	
Eastern White Pine	X				
Northern Pine	X				
Balsam Fir				X	
Eastern Hemlock-				X	
Tamarack					
amp;CRA-01&\					
Redwood		X			
SCMA-01					
Cypress			X		
SPIB-1001					
Southern Pine		X			
WCLIB Std 17					
Douglas Fir-Larch	X				
Hem-Fir	X				
Sitka Spruce	X				
Mountain Hemlock	X				
Western Cedar	X				
WWPA-01					
Douglas Fir-Larch	X				
Hem-Fir	X				
Idaho White Pine	X				
Lodgepole Pine			X		
Ponderosa Pine			X		
Sugar Pine			X		
Englemann Spruce			X		

Douglas Fir South	X
Mountain Hemlock	X
Subalpine Fir	X
Western Cedar	X

TABLE II. SPECIES AND GRADE

Wood Bumpers

Grading Rules	Species	No. 1	No. 2
---------------	---------	-------	-------

NHLA-01		
Red Oak	X	
NELMA-01		
Northern Pine		X
Eastern Hemlock-		X
Tamarack		
SPIB-1001		
Southern Pine	X	
WCLIB Std 17		
Douglas Fir-Larch		X
Hem-Fir		X
WWPA-01		
Douglas Fir-Larch		X
Hem-Fir		X
Douglas Fir-South		X

-- End of Section --

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SECTION 06200

FINISH CARPENTRY

07/98 [AMEND 0001]

GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.6 (1990) Hardboard Siding

APA-THE ENGINEERED WOOD ASSOCIATION (APA)

APA E445 (1991; Rev May 1991) Performance Standards and Policies for Structural-Use Panels

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1435 (1994) Outdoor Weathering of Plastics
ASTM D 2898 (1994) Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
ASTM D 3679 (1994) Rigid Poly(Vinyl Chloride) (PVC) Siding
ASTM F 547 (1977; R 1990) Definitions of Terms Relating to Nails for Use with Wood and Wood-Base Materials

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C9 (1995) Plywood - Preservative Treatment by Pressure Processes
AWPA C20 (1993) Structural Lumber Fire-Retardant Pressure Treatment
AWPA C27 (1993) Plywood - Fire-Retardant Pressure Treatment
WPA M4 (1995) Standard for the Care of Preservative-Treated Wood Products
AWPA P5 (1996) Standards for Waterborne Preservatives

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI-02 (1994) Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program

CALIFORNIA REDWOOD ASSOCIATION (CRA)

CRA-01 (1995) Standard Specifications for
Grades of California Redwood Lumber

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1996) Voluntary Product Standard -
Construction and Industrial Plywood
DOC PS 2 (1992) Performance Standard for
Wood-based Structural-Use Panels

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA-01 (1993) Standard Grading Rules for
Northeastern Lumber

SOUTHERN CYPRESS MANUFACTURER'S ASSOCIATION (SCMA)

SCMA-01 (1986; Supple No. 1, Aug 1993) Standard
Specifications for Grades of Southern
Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB-1001 (1994) Standard Grading Rules for
Southern Pine Lumber

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17 (1993; Supples III (A), V (A), VI
(A) Grading Rules For West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA-01 (1995; Supple Nos. 1, 2, and 3)
Western Lumber Grading Rules 95

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMMPA)

WMMPA WM 6 (1987) Industry Standard for Non-
Pressure Treating of Wood Millwork

1.2 SUBMITTAL

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 SD Drawing

Finish Carpentry; FIO

Drawings showing fabricated items and special mill and woodwork items. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation.

SD-14 SD Samples

Moldings; FIO

Fascias and Trim; FIO

Samples shall be of sufficient size to show patterns, color ranges, and types, as applicable, of the material proposed to be used.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 PRODUCT

2.1 WOOD ITEMS, SIDING, AND TRIM

The Contractor shall furnish products which optimize design by reducing the amount of wood used (engineered wood), or recycled wood products, and preservatives without arsenic or chromium when the products and methods are competitive in price or directed by the Contracting Officer.

2.1.1 Grading and Marking

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Except for plywood, structural-use panels, and lumber, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

2.1.2 Sizes and Patterns

Lumber sizes and patterns shall conform to rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Sizes and patterns for materials other than lumber shall conform to requirements of the rules or standards under which produced. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Moisture Content

The maximum moisture content of untreated trim and wood siding shall be 15 percent at the time of delivery to the jobsite and when installed. Moisture content of all other material shall be in accordance with the standard under which the product is produced.

2.1.4 Preservative Treatment

2.1.4.1 Plywood

Plywood shall be treated in accordance with AWPA C9 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

- a. 4 kg per cubic meter (0.25 pcf) intended for above ground use.
- b. 6.4 kg per cubic meter (0.4 pcf) intended for ground contact and fresh water use.

2.1.4.2 Exterior Wood Molding and Millwork

Exterior wood molding and millwork within 455 mm (18 inches) of soil, in contact with water or concrete shall be preservative-treated in accordance with WMPA WM 6. Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPA M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil.

2.1.5 Woodwork Items

2.1.5.1 Bulletin Boards

Bulletin boards shall have a hardwood or aluminum frame, 6 mm (1/4 inch) thick plywood or hardboard back; and a 6 mm (1/4 inch) thick, dense, smooth faced corkboard face securely cemented to the back.

2.1.5.2 Utility Shelving

Utility shelving shall be a suitable species equal to or exceeding requirements of No. 3 Common white fir under WMPA-01, 25 mm (1 inch) thick; or plywood, interior type, Grade A-B, 13 mm (1/2 inch) thick, any species group.

2.2 NAILS

Nails shall be the size and type best suited for the purpose and shall conform to ASTM F 547. Nails shall be hot-dip galvanized or aluminum when used on exterior work. For siding, length of nails shall be sufficient to extend 40 mm (1-1/2 inches) into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

PART 3 EXECUTION

3.1 GENERAL

3.2 WOODWORK ITEMS

3.2.1 Bulletin Boards and Chalkboards

Items shall be installed in accordance with the manufacturer's recommendation.

3.2.2 Shelving

Shelving shall be anchored to supporting construction. Unless otherwise indicated, shelves shall be supported by wall-supported brackets not more than 600 mm (24 inches) on center or as required to limit deflection to 6 mm (1/4 inch) between supports with a load of 525 N per meter. (35 lb per lineal foot.) Adjustable shelf hardware shall be steel standards, channel shaped, with 25 mm (1 inch) adjustment slots and brackets designed for attachment to standards.

3.2.3 Workbenches

Items shall be anchored in place as indicated.

TABLE I. SPECIES AND GRADE TABLES

Grading Rules	Species	Choice	Clear	C Select	C & Better
NELMA-01					
Eastern Cedar		X			
Eastern Hemlock		X			
Tamarack			X		
Eastern W. Pine			X		
Northern Pine			X		
Eastern Spruce			X		
Balsam Fir		X			
amp;CRA-01&\					
Redwood		X			
SCMA-01					
Cypress			X		
SPIB-1001					
Southern Pine			X		
WCLIB Std 17					
Douglas Fir			X		
Larch			X		
Hemlock Fir			X		
Mountain Hemlock			X		
Sitka Spruce			X		
WWPA-01					
Douglas Fir			X		
Larch			X		
Hemlock Fir		X			
Mountain Hemlock			X		
Western Larch		X			
Idaho White Pine	X				
Lodgepole Pine		X			
Ponderosa Pine		X			
Sugar Pine		X			
Englemann Spruce		X			
Douglas Fir South		X			
Subalpine Fir		X			

NOTE 1: Western Cedar under WCLIB Std 17 shall be Grade B; and under WWPA-01, Western Cedar shall be Grade B bevel for siding and Grade A for trim.

NOTE 2: Except as specified in NOTE 3 below, siding and exterior trim shall be any of the species listed above. Interior trim shall be any one of the species listed above and the highest grade of the species for stain

or natural finish and one grade below highest grade of species for paint finish.

NOTE 3: Southern Yellow Pine, Douglas Fir, Larch, Western Larch, and Tamarack shall not be used where painting is required and may be used on exterior work only when approved and stained with a preservative type stain.

-- End of Section --

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SECTION 07160

BITUMINOUS DAMPPROOFING

07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 41	(1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 1187	(1995) Asphalt-Base Emulsions for Use as Protective Coatings for Metal
ASTM D 1227	(1987) Emulsified Asphalt Used as a Protective Coating for Roofing
ASTM D 4479	(1993) Asphalt Roof Coatings - Asbestos Free

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-13 Certificates

Materials; GA

Certificates attesting that the materials meet the requirements specified.

1.3 QUALIFICATIONS

Work shall be performed by skilled laborers thoroughly experienced in the type of bituminous dampproofing work specified to meet the requirements of the contract.

1.4 DELIVERY, STORAGE AND HANDLING

Dampproofing materials shall be delivered to the project site in the original sealed containers bearing the name of manufacturer, contents and brand name, and stored in a weathertight enclosure to prevent moisture damage and absorption. Dampproofing materials shall be protected from freezing. Asphalt shall be stored off the ground on pallets, and covered on top and all sides with breathable-type canvas tarpaulins. Plastic sheets cause condensation buildup and therefore shall not be used to cover dampproofing materials. Care shall be taken during storage to avoid

separation or settlement of the emulsion components. Damaged or deteriorated materials shall be removed from the project site.

PART 2 PRODUCTS

2.1 EMULSION-BASED ASPHALT DAMPPROOFING

2.1.1 Fibrated Emulsion-Based Asphalt

Fibrated emulsion-based asphalt dampproofing shall be cold-applied type conforming to ASTM D 1227 Type IV, asbestos-free, manufactured of refined asphalt, emulsifiers and selected clay, fibrated with mineral fibers. For spray or brush application, emulsion shall contain a minimum of 59 percent solids by weight, 56 percent solids by volume. For trowel application, emulsion shall contain a minimum of 58 percent solids by weight, 55 percent solids by volume.

2.2 SOLVENT-BASED ASPHALT DAMPPROOFING

2.2.1 Asphaltic Primer

Primer for cold-applied solvent-based asphalt dampproofing shall conform to ASTM D 41, asbestos-free, non-fibrated, manufactured with highly ductile soft asphalts and selected hydrocarbons.

2.2.2 Fibrated Asphalt

Fibrated solvent-based asphalt dampproofing shall be cold-applied type conforming to ASTM D 4479 Type I, asbestos-free, manufactured with selected asphalts, stabilizers, mineral spirits and fibrated with mineral fibers. Solvent-based asphalt shall contain 72 percent solids by weight, 65 percent solids by volume.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Surfaces scheduled for bituminous dampproofing shall be prepared in accordance with dampproofing manufacturer's recommendations. Surface preparation shall be approved prior to dampproofing application.

3.1.1 Protection of Surrounding Areas

Before starting the dampproofing work, the surrounding areas and surfaces shall be protected from spillage and migration of asphalt onto other work. Drains and conductors shall be protected from clogging with asphalt.

3.1.2 Masonry Surfaces

Surfaces shall be free of oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Mortar joints shall be flush and free of extraneous mortar and chipped or broken masonry.

3.1.3 Concrete Surfaces

Surfaces shall be properly cured, free of form release agents, oil, grease,

dirt, laitance, loose material, frost, debris and other contaminants. Form ties shall be cut flush with surface. Sharp protrusions and form match lines shall be removed. Holes, voids, spalled areas and cracks which can damage the dampproofing materials and impair performance shall be repaired. Rough surfaces shall be parged with a well-adhering coat of cement mortar.

3.1.4 Metal Surfaces

Metal surfaces shall be dry and be free of rust, scale, loose paint, oil, grease, dirt, frost and debris.

3.2 APPLICATION OF BITUMINOUS DAMPPROOFING

3.2.1 Emulsion-Based Asphalt

Emulsion-based asphalt dampproofing work shall not be performed in temperatures below 40 degrees F. Emulsions shall have a smooth and uniform consistency at time of application. Dampproofing materials shall be applied in accordance with manufacturer's published instructions to produce a smooth uniform dry film of not less than 12 mils thick without voids or defects. Dull or porous spots shall be recoated. Dampproofing materials shall seal tightly around pipes and other items projecting through dampproofing. Rates of application shall be as follows:

- a. Primer: 1/2 gallon per 100 square feet, cold-applied.
- b. Fibrated Dampproofing: 2 gallons per 100 square feet, cold-applied with spray, brush or trowel.
- c. Non-fibrated Dampproofing: 2 gallons per 100 square feet, cold-applied with spray, brush or trowel.

3.2.2 Solvent-Based Asphalt

Solvent-based asphalt dampproofing work shall not be performed in temperatures below 40 degrees F. Dampproofing materials shall be applied in accordance with manufacturer's published instructions to produce a smooth uniform dry film not less than 12 mils thick without voids or defects. Dull or porous spots shall be recoated. Dampproofing materials shall seal tightly around pipes and other items projecting through dampproofing. Rates of application shall be as follows:

- a. Primer: 1/2 gallon per 200 square feet, cold-applied.
- b. Dampproofing Coat: 2 gallons per 100 square feet, cold-applied with spray, brush or trowel.

3.3 CLEAN-UP

Surfaces of other work which are stained with dampproofing materials shall be cleaned with a cleaner recommended by dampproofing manufacturer.

3.4 PROTECTION

The completed dampproofing work shall be protected from damage during and after construction.

-- End of Section --

SECTION 07270

FIRESTOPPING

07/98 [ANEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84 (1995a) Surface Burning Characteristics of Building Materials

ASTM E 814 (1994b) Fire Tests of Through-Penetration Fire Stops

UNDERWRITERS LABORATORIES (UL)

UL-05 (1995; Supple) Fire Resistance Directory

UL 723 (1993; Rev Apr 1994) Test for Surface Burning Characteristics of Building Materials

UL 1479 (1994) Fire Tests of Through-Penetration Firestops

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Firestopping Materials;FIO 7270.

Detail drawings including manufacturer's descriptive data, typical details, installation instructions and the fire-test data and/or report as appropriate for the fire resistance rated construction and location. Submittal shall indicate the firestopping material to be provided for each type of application. When more than 5 penetrations are to receive firestopping, drawings shall indicate location and type of application.

SD-13 Certificates

Firestopping Materials;FIO 7270.

Certificates attesting that firestopping material complies with the specified requirements. The label or listing of the Underwriters Laboratories will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing agency equipped to perform such services, stating that the items have been tested and conform to the specified requirements and testing methods.

Installer Qualifications;FIO 7270.

Certification stating that installer is qualified and trained to install the specified firestopping material.

Inspection;FIO 7270.

Manufacturer's representative certification stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

1.3 GENERAL REQUIREMENTS

Firestopping shall consist of furnishing and installing a material or a combination of materials to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.

1.4 STORAGE AND DELIVERY

Materials shall be delivered in the original unopened packages or containers showing name of the manufacturer and the brand name. Materials shall be stored off the ground and shall be protected from damage and exposure to elements. Damaged or deteriorated materials shall be removed from the site.

1.5 INSTALLER QUALIFICATIONS

Installer of firestopping material shall be trained by the manufacturer or the manufacturer's representative, and shall have a minimum of 3 years experience in the installation of firestopping of the type specified.

PART 2 PRODUCTS

2.1 FIRESTOPPING MATERIALS

Firestopping materials shall consist of commercially manufactured products complying with the following minimum requirements:

2.1.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E 84 or UL 723.

Material shall be an approved firestopping material as listed in UL-05.

2.1.2 Toxicity

Material shall be nontoxic to humans at all stages of application.

2.1.3 Fire Resistance Rating

Firestopping will not be required to have a greater fire resistance rating than that of the assembly in which it is being placed.

2.1.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph GENERAL REQUIREMENTS, shall provide "F" and "T" fire resistance ratings in accordance with ASTM E 814 or UL 1479, except that T Ratings are not required for penetrations smaller than or equal to a 4 inch nominal pipe or 16 square inches in overall cross sectional area. Fire resistance ratings shall be the following:

- a. Penetrations of Fire Resistance Rated Walls and Partitions: F Rating = 2 hour, T Rating = 2 hour.

2.1.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph GENERAL REQUIREMENTS, and gaps such as those between floor slabs or roof decks and curtain walls shall be the same as the construction in which they occur.

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system.

3.2 INSTALLATION

Firestopping material shall completely fill void spaces regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping for filling floor voids 4 inches or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Firestopping shall be installed in accordance with manufacturer's written instructions. Firestopping shall be provided in the following locations, except in floor slabs on grade:

- a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.
- b. Penetrations of vertical shafts such as pipe chases, elevator

shafts, and utility chutes.

- c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.
- d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
- e. Construction joints in floors and fire rated walls and partitions.
- f. Other locations where required to maintain fire resistance rating of the construction.

3.3 INSPECTION

Firestopped areas shall not be covered or enclosed until inspection is complete and approved. A manufacturer's representative shall inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements.

-- End of Section --

SECTION 09250

GYPSUM WALLBOARD

07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications of the latest edition listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 580	(1995a) Stainless and Heat Resisting Steel Wire
ASTM A 853	(1993) Steel Wire, Carbon, for General Use
ASTM B 164	(1993) Nickel-Copper Alloy Rod, Bar, and Wire
ASTM C 36	(1995) Gypsum Wallboard
ASTM C 79	(1994) Gypsum Sheathing Board
ASTM C 475	(1994) Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C 514	(1996) Nails for the Application of Gypsum Board
ASTM C 557	(1993a) Adhesive for Fastening Gypsum Wallboard to Wood Framing
ASTM C 630	(1996a) Water-Resistant Gypsum Backing Board
ASTM C 645	(1995) Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board
ASTM C 754	(1996) Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board
ASTM C 840	(1996) Application and Finishing of Gypsum Board
ASTM C 931	(1995) Exterior Gypsum Soffit Board
ASTM C 955	(1995) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Board and Metal Plaster Bases
ASTM C 960	(1996) Predecorated Gypsum Board
ASTM C 1002	(1996a) Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases
ASTM C 1047	(1994) Accessories for Gypsum Wallboard and Gypsum Veneer Base

GYPSUM ASSOCIATION (GA)

GA 216	(1996) Application and Finishing of Gypsum Board
GA 600	(1994) Fire Resistance Design Manual

UNDERWRITERS LABORATORIES (UL)

UL-05	(1997) Fire Resistance Directory
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1.2 SYSTEM DESCRIPTION

1.2.1 Fire-Rated Construction

Joints of fire-rated gypsum board enclosures shall be closed and sealed in accordance with UL test requirements or GA requirements, and as required to meet pressurization requirements. Penetrations through rated partitions and ceilings shall be sealed tight in accordance with tested systems. Fire ratings shall be as indicated.

1.2.2 Pressurized Enclosures

Pressurized fire-rated gypsum board enclosures shall allow the mechanical and electrical life-safety systems to operate in accordance with the design intent. Air pressure within elevator shaft shall be 360 Pa. (7.5 psf.) Air pressure within stair shaft shall be 240 Pa. (5.0 psf.) Maximum mid-span deflection shall be L/360.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 SD Drawings

Steel Framing; FIO
Control Joints; FIO

SD-13 SD certificates

Gypsum Wallboard; FIO

Steel Framing; FIO

Fire-Rated Gypsum Board; FIO

Certificates stating that the steel framing and gypsum wallboard meet the specified requirements.

1.4 QUALIFICATIONS

Manufacturer shall specialize in manufacturing the types of material specified and shall have a minimum of 5 years of documented

successful experience. Installer shall specialize in the type of gypsum board work required and shall have a minimum of 3 years of documented successful experience.

1.5 DELIVERY, STORAGE AND HANDLING

Materials shall be delivered in original containers bearing the name of manufacturer, contents, and brand name. Materials shall be stored off the ground in a weathertight structure for protection. Gypsum boards shall be stacked flat, off floor and supported to prevent sagging and warpage. Adhesives and joint materials shall be stored in accordance with manufacturer's printed instructions. Damaged or deteriorated materials shall be removed from jobsite.

1.6 ENVIRONMENTAL CONDITIONS

Environmental conditions for application and finishing of gypsum board shall be in accordance with ASTM C 840. During the application of gypsum board without adhesive, a room temperature of not less than 4 degrees C (40 degrees F) shall be maintained. During the application of gypsum board with adhesive, a room temperature of not less than 10 degrees C (50 degrees F) shall be maintained for 48 hours prior to application and continuously afterwards until completely dry. Building spaces shall be ventilated to remove water not required for drying joint treatment materials. Drafts shall be avoided during dry hot weather to prevent materials from drying too rapidly

PART 2 PRODUCT

2.1 NON-LOADBEARING STUD WALLS

2.1.1 Studs

Studs for non-loadbearing walls shall conform to ASTM C 645. Studs shall be C-shaped, roll formed steel with minimum uncoated design thickness of 0.45 mm (0.0179 in) made from G40 hot-dip galvanized coated sheet.

2.1.2 Runner Tracks

Floor and ceiling runner tracks shall conform to ASTM C 645. Tracks shall be prefabricated, U-shaped with minimum 25 mm (1 inch) flanges, unpunched web, thickness to match studs, made from G40 hot-dip galvanized coated sheet.

2.2 SUSPENDED CEILING FRAMING

Carrying channels shall be formed from 1.40 mm (0.0548 in) thick cold-rolled steel, 38 x 19 mm. (1-1/2 x 3/4 inch.) Furring members shall be formed from cold-rolled steel, 22 x 65 mm. (7/8 x 2-9/16 inch.) Carrying channels and furring members shall be made from hot-dip galvanized coated sheet.

2.3 GYPSUM BOARD

Gypsum board shall have square-cut ends, tapered or beveled edges and shall be maximum possible length. Gypsum board thickness shall be as shown.

2.3.1 Fire-Rated Gypsum Board

Fire-rated gypsum board shall conform to ASTM C 36, and shall be Type X or Type C as required, 1200 mm (48 inches) wide.

2.4 TRIM, MOLDINGS, AND ACCESSORIES

2.4.1 Taping and Embedding Compound

Taping and embedding compound shall conform to ASTM C 475. Compound shall be specifically formulated and manufactured for use in embedding tape at gypsum wallboard joints and fastener heads, and shall be compatible with tape and substrate.

2.4.2 Finishing or Topping Compound

Finishing or topping compound shall conform to ASTM C 475. Compound shall be specifically formulated and manufactured for use as a finishing compound for gypsum board.

2.4.3 All-Purpose Compound

All-purpose compound shall be specifically formulated and manufactured to use as a taping and finishing compound, and shall be compatible with tape and substrate.

2.4.4 Joint Tape

Joint tape shall conform to ASTM C 475 and shall be as recommended by gypsum board manufacturer.

2.4.5 Trim, Control Joints, Beads, Stops and Nosings

Items used to protect edges, corners, and to provide architectural features shall be in accordance with ASTM C 1047.

2.5 FASTENINGS AND ADHESIVES

2.5.1 Screws

Screws shall conform to ASTM C 1002. Screws shall be self-drilling and self-tapping steel, Type G for gypsum board to gypsum board Type S for wood or light-gauge steel framing.

2.5.2 Adhesives

Adhesives shall conform to ASTM C 557. Adhesives shall be formulated to bond gypsum board to wood framing members. For securing gypsum board to metal framing, adhesive shall be as recommended by gypsum board manufacturer.

2.5.3 Hangers

Suspended ceiling runner channel hangers shall be soft, annealed steel wire not less than No. 8 SWG, conforming to ASTM A 853 or flat iron or steel straps, at least 2 x 22 mm (3/32 x 7/8 inch) size, coated with zinc, cadmium, or rust-inhibiting paint.

2.5.4 Wire and Clip Type Fastenings

Tie wire, clips, rings, and other fastenings shall be corrosion-resisting steel conforming to ASTM A 580, composition 302, 304, or 316, Condition A, or nickel-copper alloy conforming to ASTM B 164, annealed condition except that walls, partitions, and other vertical surfaces not incorporated in ceiling construction may be erected with soft, annealed steel conforming to ASTM A 853.

2.5.4.1 Tie Wire

Tie wire for constructing partitions and vertical furring, for securing metal lath to supports, and for lacing shall be not less than No. 18 SWG. Tie wire for other applications shall be not less than No. 16 SWG.

2.5.4.2 Clips

Clips used in lieu of tie wire for securing the furring channels to the runner channels in ceiling construction shall be made from strip not less than 3 mm (1/8 inch) thick or shall be hairpin clip, formed of wire not less than 0.4 mm (0.01620 inch) nominal diameter. Other clips and rings or fastenings of similar materials shall be equivalent in holding power to that provided by tie wire for the specific application.

PART 3 EXECUTION

3.1 INTERIOR WALL FRAMING

Steel framing and furring members shall be installed in accordance with ASTM C 754. Members shall be in alignment with spacings not to exceed the maximum spacings indicated on drawings. Runners shall be aligned accurately at the floor and ceiling and securely anchored.

3.1.1 Wall Openings

The framing system shall provide for the installation and anchorage of the required subframes or finish frames for wall openings at doors, pass-through openings, and access panels. Partitions abutting continuous suspended ceilings shall be strengthened for rigidity at rough openings of more than 750 mm (30 inches) wide. Studs at openings shall be 0.84 mm (0.0329 in) minimum bare metal thickness and spotgrouted at jamb anchor inserts. Double studs shall be fastened together with screws and secured to floor and overhead runners. Two studs placed back-to-back shall be used for framing solid-core doors, doors over 900 mm (36 inches) wide and extra-heavy doors such as X-ray room doors.

3.1.2 Wall Control Joints

Control joints for expansion and contraction in the walls shall be constructed with double studs installed 13 mm (1/2 inch) apart in interior walls or wall furrings where indicated on drawings. Control joint spacing shall not exceed 9 m. (30 feet.) Ceiling-height

door frames may be used as vertical control joints. Door frames of less than ceiling height may be used as control joints only if standard control joints extend to ceiling from both corners of top of door frame. Control joints between studs shall be filled with firesafing insulation in fire rated partitions.

3.2 SUSPENDED CEILING FRAMING

Suspended ceiling system framing shall be installed in accordance with ASTM C 754.

3.2.1 Hangers

Hangers shall be spaced not more than 1200 mm (48 inches) along runner channels and 900 mm (36 inches) in the other direction or 1050 mm (42 inches) in both directions unless otherwise indicated. Locations of hanger wires shall be coordinated with other work. Hangers at ends of runner channels shall be located not more than 150 mm (6 inches) from wall. Hanger wire shall be looped around bottom chord of open-web steel joists, or secured to structural elements with suitable fasteners. Sags or twists which develop in the suspended system shall be adjusted. Damaged or faulty parts shall be replaced.

3.2.2 Main Runners

Main runner channels shall be installed in accordance with ASTM C 754. Hanger wires shall be double strand saddle-tied to runner channels and the ends of hanger wire shall be twisted three times around itself. Main runners shall be located to within 150 mm (6 inches) of the paralleling wall to support the ends of cross furring. Main runners shall not come in contact with abutting masonry or concrete walls. Where main runners are spliced, ends shall be overlapped 300 mm (12 inches) with flanges of channels interlocked, and shall be securely tied at each end of splice with wire looped twice around the channels.

3.2.3 Furring Channels

Furring channels shall be spaced in accordance with ASTM C 754. Furring channels shall be secured to the runner channels and to structural supports at each crossing with tie wire, hairpin clips, or equivalent fastenings. Furring channels shall be located within 50 mm (2 inches) of parallel walls and beams, and shall be cut 13 mm (1/2 inch) short of abutting walls.

3.2.4 Ceiling Openings

Support members shall be provided as required at ceiling openings for access panels, recessed light fixtures, and air supply or exhaust. Support members shall be not less than 38 mm (1-1/2 inch) main runner channels and vertically installed suspension wires or straps shall be located to provide at least the minimum support specified herein for furring and wallboard attachment. Intermediate structural members not a part of the structural system, shall be provided for attachment or suspension of support members.

3.2.5 Light Fixtures

Light fixtures shall not be supported directly from suspended ceiling runners. Hanger wires for recessed or surface mounted light fixtures shall be anchored to structure at four corners of light fixtures, and additional wires shall be provided at appropriate locations to carry the weight of light fixtures.

3.2.6 Control Joints

Ceiling control joints for expansion and contraction shall be located where indicated on drawings. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.

3.2.6.1 Interior Ceilings With Perimeter Relief

Control joints shall be installed so that linear dimensions between control joints shall not exceed 15 m (50 feet) in either direction nor more than 230 square meters.

3.3.6.2 Interior Ceilings Without Perimeter Relief

Control joints shall be installed so that linear dimensions between control joints shall not exceed 9 m (30 feet) in either direction nor more than 84 square meters (900 square feet).

3.4 APPLICATION OF GYPSUM BOARD

Gypsum board shall be installed in accordance with ASTM C 840 and GA 216 and as specified. Edges and ends of gypsum boards shall be cut to obtain neat fitting joints. End joints of adjoining boards shall be staggered, and shall be staggered on opposite sides of wall. Boards shall be applied with moderate contact without forcing in place. Holes for pipes, fixtures or other small openings shall be cut with a tool which will provide a neat fit. Screws shall be driven so that the heads are slightly below the plane of paper face. Fracturing the paper face or damaging the core shall be avoided. Trim shall be installed at external and internal angles formed by the intersecting gypsum board surfaces with other surfaces. Corner beads shall be installed to vertical and horizontal corners in accordance with manufacturer's published instructions.

3.5 TRIM, MOLDINGS, AND ACCESSORIES INSTALLATION

Trim, moldings and accessories shall be installed in accordance with GA 216.

3.6 TAPING AND FINISHING

Gypsum board taping and finishing shall be performed in accordance with ASTM C 840. Boards shall be kept free of dirt, oil and other foreign matter that could cause a lack of bond. Screw heads, dents, gouges, and cut-outs shall be filled with joint compound and sanded. Accessories at exposed joints, edges, corners, openings, and similar locations shall be taped, floated with joint compound, and sanded to produce surfaces ready for gypsum board finishes.

3.7 PATCHING

Surface defects and damage shall be corrected as required to leave gypsum

board smooth, uniform in appearance, and ready to receive finish as specified.

-- End of Section --

SECTION 09310

CERAMIC TILE

07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications of the latest edition listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.1	(1992) Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar
ANSI A108.1B	(1992) Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar
ANSI A108.4	(1992) Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive
ANSI A108.5	(1992) Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
ANSI A108.6	(1992) Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy
ANSI A108.7	(1992) Electrically Conductive Ceramic Tile Installed with Conductive Dry-Set Portland Cement Mortar
ANSI A108.8	(1992) Installation of Ceramic Tile with Chemical Resistant Furan Mortar and Grout
ANSI A108.10	(1992) Installation of Grout in Tilework
ANSI A108.11	(1992) Interior Installation of Cementitious Backup Units
ANSI A118.1	(1992) Dry-Set Portland Cement Mortar
ANSI A118.2	(1992) Conductive Dry-Set Portland
ANSI A118.3	(1992) Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive
ANSI A118.4	(1992) Latex-Portland Cement Mortar
ANSI A118.5	(1992) Chemical Resistant Furan

	Mortars
	and Grouts for Tile
ANSI A118.6	(1992) Ceramic Tile Grouts
ANSI A118.9	(1992) Test Methods and Specifications
	for Cementitious Backer Units
ANSI A136.1	(1992) Organic Adhesives for
	Installation of Ceramic Tile
ANSI A137.1	(1988) Ceramic Tile

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185	(1994) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM C 33	(1993) Concrete Aggregates
ASTM C 144	(1994) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM C 150	(1996) Portland Cement
ASTM C 206	(1984; R 1992) Finishing Hydrated Lime
ASTM C 207	(1991; R 1992) Hydrated Lime for Masonry Purposes
ASTM C 241	(1990) Abrasion Resistance of Stone Subjected to Foot Traffic
ASTM C 150	(1996) Portland Cement
ASTM C 207	(1991; R 1992) Hydrated Lime for Masonry Purposes
ASTM C 241	(1994) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM C 373	(1988; R 1994) Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products
ASTM C 648	(1984; R 1994) Breaking Strength of Ceramic Tile
ASTM C 847	(1995) Metal Lath
ASTM C 1026	(1987; R 1992) Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling
ASTM C 1027	(1984; R 1990) Determining Visible Abrasion Resistance of Glazed Ceramic Tile
ASTM C 847	(1995) Metal Lath
ASTM C 1026	(1987; R 1992) Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling
ASTM C 1028	(1989) Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method

MARBLE INSTITUTE OF AMERICA (MIA)

MIA-01	(1991) Design Manual IV Dimensional Stoner
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 99	(1996) Health Care Facilities
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TILE COUNCIL OF AMERICA (TCA)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 SD Data

Tile; FIO

Setting-Bed; FIO

Mortar, Grout, and Adhesive; FIO

Manufacturer's catalog data.

SD-06 SD Instructions

Tile; FIO

Mortar and Grout; FIO

Manufacturers preprinted installation and cleaning instructions.

Copy of results for electrical resistance tests.

SD-13 SD Certificates

Tile; FIO

Mortar, Grout, and Adhesive; FIO;09310.

Certificates indicating conformance with specified requirements. A master grade certificate shall be furnished for tile.

SD-14 SD Samples Tile

Accessories; GA

Marble Thresholds; GA

Samples of sufficient size to show color range, pattern, type and joints.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather, and stored under cover.

1.4 ENVIRONMENTAL REQUIREMENTS

Ceramic tile work shall not be performed unless the substrate and ambient temperature is at least 10 degrees C (50 degrees F) and rising. Temperature shall be maintained above 10 degrees C (50 degrees F) while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used they shall be vented to the outside to avoid carbon dioxide damage to new tilework.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period shall be provided.

PART 2 PRODUCT

2.1 TILE

Tile shall be standard grade conforming to ANSI A137.1. Containers shall be grade sealed. Seals shall be marked to correspond with the marks on the signed master grade certificate. Tile shall be impact resistant with a minimum breaking strength for wall tile of 41 kg (90 lbs) and 113 kg (250 lbs) for floor tile in accordance with ASTM C 648. Tile for cold climate projects shall be rated frost resistant by the manufacturer as determined by ASTM C 1026. Water absorption shall be 0.5 maximum percent in accordance with ASTM C 373. Floor tile shall have a minimum static coefficient of friction of 0.5 in accordance with ASTM C 1028. Tile shall be Class III as rated by the manufacturer when tested in accordance with ASTM C 1027 for abrasion resistance as related to foot traffic.

2.1.1 Mosaic Tile

Ceramic mosaic tile and trim shall be unglazed natural clay with cushion edges. Tile size shall be 50 x 50 mm (2 x 2 inches) color shall be as indicated on drawings

2.2 SETTING-BED

The setting-bed shall be composed of the following:

2.2.1 Aggregate for Concrete Fill

Aggregate shall conform to ASTM C 33. Maximum size of coarse aggregate shall not be greater than one-half the thickness of concrete fill.

2.2.2 Portland Cement

Cement shall conform to ASTM C 150, Type I, white for wall mortar and gray for other uses.

2.2.3 Sand

Sand shall conform to ASTM C 144.

2.2.4 Hydrated Lime

Hydrated lime shall conform to ASTM C 206, Type S or ASTM C 207,

Type S.

2.2.5 Metal Lath

Metal lath shall be flat expanded type conforming to ASTM C 847 and weighing not less than 1.4 kg/square meter. (2.5 pounds per square yard.)

2.2.6 Reinforcing Wire Fabric

Wire fabric shall conform to ASTM A 185. Wire shall be either 50 x50 mm (2 x 2 inch) mesh, 16/16 wire or 38 x 50 mm (1-1/2x 2inch) mesh, 16/13 wire.

2.3 WATER

Water shall be potable.

2.4 MORTAR, GROUT, AND ADHESIVE

Mortar, grout, and adhesive shall conform to the following:

2.4.1 Latex-Portland Cement Mortar

ANSI A118.4.

2.4.2 Ceramic Tile Grout

ANSI A118.6;
latex-portland cement grout

2.5 MARBLE THRESHOLDS

Marble thresholds shall be of size required by drawings or conditions. Marble shall be Group A as classified by MIA-01. Marble shall have a fine sand-rubbed finish and shall be white or gray in color as approved by the Contracting Officer. Marble abrasion shall be not less than 12.0 when tested in accordance with ASTM C 241

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

Surface to receive tile shall be inspected and shall conform to the requirements of ANSI A108.1A or ANSI A108.1B for surface conditions for the type setting bed specified and for workmanship. Variations of surface to be tiled shall fall within maximum values shown below:

TYPE	WALLS	FLOORS
Latex portland cement mortar	3 mm in 2.4 meters	3.0 mm in 3 meters

TYPE	WALLS	FLOORS
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Latex portland cement mortar 1/8 inch in 8 ft. 1/8 inch in 10 ft.

3.2 GENERAL INSTALLATION REQUIREMENTS

Tile work shall not be started until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Floor tile installation shall not be started in spaces requiring wall tile until after wall tile has been installed. Tile in colors and patterns indicated shall be applied in the area shown on the drawings. Tile shall be installed with the respective surfaces in true even planes to the elevations and grades shown. Special shapes shall be provided as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Tile bases and coves shall be solidly backed with mortar.

3.3 INSTALLATION OF WALL TILE

Wall tile shall be installed in accordance with the TCA-01, method W243.

3.3.1 Latex-Portland Cement Mortar

Latex-portland cement shall be used to install tile in accordance with ANSI A108.5. Latex portland cement shall be used when installing porcelain ceramic tile.

3.4 INSTALLATION OF FLOOR TILE

Floor tile shall be installed in accordance with TCA-01, method F102.

3.4.1 Latex-Portland Cement

Latex-portland cement mortar shall be used to install tile directly over properly cured, plane, clean concrete slabs in accordance with ANSI A108.5. Latex portland cement shall be used when installing porcelain ceramic tile.

3.4.2 Ceramic Tile Grout

Ceramic Tile grout shall be prepared and installed in accordance with ANSI A108.10.

3.5 INSTALLATION OF MARBLE THRESHOLDS

Thresholds shall be installed where indicated in a manner similar to that of the ceramic tile floor. Thresholds shall be the full width of the opening. Head joints at ends shall not exceed 6 mm (1/4 inch) in width and shall be grouted full as specified for ceramic tile.

3.6 CONTROL JOINTS

Joints shall be formed as indicated and sealed as specified in Section

07900 JOINT SEALING.

3.6.1 Walls

Control joints shall be provided at control joints in backing material. Wherever backing material changes, a control joint shall be formed to separate the different materials.

3.6.2 Floors

Control joints shall be provided over construction joints, control joints, and expansion joints in concrete slabs. Control joints shall also be provided where tile abuts restraining surfaces such as perimeter walls, curbs and columns and at intervals of 7.2 to 10.8 m (24 to 36 feet) each way in large interior floor areas and 3.6 to 4.8 m (12 to 16 feet) each way in large exterior areas or areas exposed to direct sunlight or moisture. Expansion joints shall extend through setting-beds and fill.

3.7 CLEANING AND PROTECTING

Upon completion, tile surfaces shall be thoroughly cleaned in accordance with manufacturer's approved cleaning instructions. Acid shall not be used for cleaning glazed tile. Floor tile with resinous grout or with factory mixed grout shall be cleaned in accordance with instructions of the grout manufacturer. After the grout has set, tile wall surfaces shall be given a protective coat of a noncorrosive soap or other approved method of protection. Tiled floor areas shall be covered with building paper before foot traffic is permitted over the finished tile floors. Board walkways shall be laid on tiled floors that are to be continuously used as passageways by workmen. Damaged or defective tiles shall be replaced.

-- End of Section --
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SECTION 09445

RESINOUS TERRAZZO FLOORING
07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

NATIONAL TERRAZZO & MOSAIC ASSOCIATION (NTMA)

NTMA-01 (1994) Terrazzo Information Guide

1.2 GENERAL

Resinous terrazzo flooring shall be a polyacrylate terrazzo system that conforms to paragraph 2.01G of NTMA-01 .

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Terrazzo Floor System; GA.

Manufacturer's descriptive data, mixing, proportioning, and installation instructions. Maintenance literature for terrazzo shall be included.

SD-14 Samples

Terrazzo Floor System; GA.

Two samples, minimum 150 by 150 mm, of each color of resinous terrazzo and two samples, minimum 150 mm long, of each type of plastic strip.

1.4 QUALIFICATION OF APPLICATOR

Applicator shall be approved by the resin manufacturer and shall have a minimum of 3 years experience in the application of the materials to be used.

1.5 DELIVERY AND STORAGE

Materials shall be delivered and stored in accordance with manufacturer's instructions.

1.6 ENVIRONMENTAL REQUIREMENTS

Areas to receive terrazzo shall be maintained at a temperature above 15 degrees C for 2 days prior to installation and for 7 days following installation.

PART 2 PRODUCTS

2.1 PRIMER

Primer shall be a material recommended by the binder manufacturer.

2.2 BINDER

Binder for polyacrylate terrazzo shall conform to paragraph 2.01A of NTMA-01.

2.3 FILLERS

Fillers, if required, shall be inert mineral or cellulosic material as recommended.

2.4 AGGREGATE

Aggregate shall be a blend of plastic chips in a range of sizes up to and including the Standard No. 1 chip referenced in NTMA-01.

2.5 PLASTIC STRIPS

Plastic strips shall be of type and size as recommended by the manufacturer.

2.6 GROUT

Grout shall be as recommended by the manufacturer of the resin.

2.7 SEALER

Sealer shall be a colorless, nonslip, nonyellowing resistant to stain product recommended by the manufacturer of the resin.

2.8 COLOR

Color of resinous terrazzo flooring shall be as shown on drawings.

PART 3 EXECUTION

3.1 INSTALLATION

Installation of the floor topping shall be in accordance with manufacturer's approved instructions.

3.2 PROTECTION

The terrazzo work shall be covered and protected from damage until completion of the work of all other trades.

-- End of Section --

SECTION 09510

ACOUSTICAL CEILINGS

07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 635	(1995) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C 636	(1992) Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM E 119	(1995a) Fire Tests of Building Construction and Materials
ASTM E 1264	(1990) Standard Classification for Acoustical Ceiling Products
ASTM E 1414	(1991a) Standard Test for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.

UNDERWRITERS LABORATORIES (UL)

UL-05	(1996) Fire Resistance Directory
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1.2 GENERAL REQUIREMENTS

Acoustical treatment shall consist of sound controlling units mechanically mounted on a ceiling suspension system. The unit size, texture, finish, and color shall be as specified. The location and extent of acoustical treatment shall be as shown on the drawings.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 SD Data
Acoustical Ceiling System; FIO

Manufacturer's descriptive data, catalog cuts, and installation instructions.

SD-13 SD Certificates

Acoustical Units; FIO

Certificate attesting that the mineral based acoustical units furnished for the project contains recycled material and showing an estimated percent of such material.

SD-14 SD Samples

Acoustical Units; GA

Two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials shall be carefully handled and stored in dry, watertight enclosures. Immediately before installation, acoustical units shall be stored for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.5 ENVIRONMENTAL REQUIREMENTS

A uniform temperature of not less than 16 degrees C (60 degrees F) nor more than 29 degrees C (85 degrees F) and a relative humidity of not more than 70 percent shall be maintained before, during, and after installation of acoustical units.

1.6 SCHEDULING

Interior finish work such as plastering, concrete and terrazzo work shall be complete and dry before installation. Mechanical, electrical, and other work above the ceiling line shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

1.8 EXTRA MATERIALS

Spare tiles of each color shall be furnished at the rate of 5 tiles for each 1000 tiles installed. Tiles shall be from the same lot as those installed.

PART 2 PRODUCT

2.1 ACOUSTICAL UNITS

Acoustical units shall conform to ASTM E 1264, Class A, and the

following requirements:

2.1.1 Units for Exposed-Grid System A

Type: IX (mineral fiber with scrubbable finish)

Type IX acoustical units shall have a minimum recycled material content of 18 percent.

Minimum NRC: 0.55 when tested on mounting No. E-400

Pattern: C, D

Nominal size: 600 by 1200mm.(24 by 48inches.)

Edge detail: SQUARE-CUT LAY-IN.

Finish: Factory-applied standard finish .

Minimum LR coefficient: 0.80.

Minimum CAC: 40.

2.2 SUSPENSION SYSTEM

Suspension system shall be standard exposed-grid standard width flange and shall conform to ASTM C 635 Surfaces exposed to view shall be aluminum or steel with a factory-applied white. Wall molding shall have a flange of not less than 23 mm (15/16 inch). Standard shall be provided.

2.3 HANGERS

Hangers shall be galvanized steel wire. Hangers and attachment shall support a minimum 1330 N (300 pound) ultimate vertical load without failure of supporting material or attachment.

2.4 FINISHES

Acoustical units and suspension system members shall have manufacturer's standard textures, patterns and finishes as specified. Ceiling suspension system components shall be treated to inhibit corrosion.

2.5 COLORS AND PATTERNS

Colors and patterns for acoustical units and suspension system components shall be as specified in on drawings.

2.6 CEILING ATTENUATION CLASS AND TEST

Ceiling attenuation class (CAC) range of acoustical units, when required, shall be determined in accordance with ASTM E 1414. Test ceiling shall be continuous at the partition and shall be assembled in the suspension system in the same manner that the ceiling will be installed on the project. System shall be tested with all acoustical units installed.

PART EXECUTION

3.1 INSTALLATION

Acoustical work shall be provided complete with necessary fastenings, clips, and other accessories required for a complete installation. Mechanical fastenings shall not be exposed in the finished work. Hangers shall be laid out for each individual room or space. Hangers shall be placed to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Main runners and carrying channels shall be kept clear of abutting walls and partitions. At least two main runners shall be provided for each ceiling span. Wherever required to bypass an object with the hanger wires, a subsuspension system shall be installed, so that all hanger wires will be plumb.

3.1.1 Suspension System

Suspension system shall be installed in accordance with ASTM C 636 and as specified herein. There shall be no hanger wires or other loads suspended from underside of steel decking.

3.1.2 Plumb Hangers

Hangers shall be plumb and shall not press against insulation covering ducts and pipes.

3.1.3 Wall Molding

Wall molding shall be provided where ceilings abut vertical surfaces. Wall molding shall be secured not more than 75 mm (3 inches) from ends of each length and not more than 400 mm (16 inches) on centers between end fastenings. Wall molding springs shall be provided at each acoustical unit in semi-exposed or concealed systems.

3.1.4 Acoustical Units

Acoustical units shall be installed in accordance with the approved installation instructions of the manufacturer. Edges of acoustical units shall be in close contact with metal supports, with each other, and in true alignment. Acoustical units shall be arranged so that units less than one-half width are minimized. Units in exposed-grid system shall be held in place with manufacturer's standard hold-down clips, if units weigh less than 5 kg per square m (1 psf) or if required for fire resistance rating.

3.2 CEILING ACCESS PANELS

Ceiling access panels shall be located directly under the items which require access.

3.3 CLEANING

Following installation, dirty or discolored surfaces of acoustical units shall be cleaned and left free from defects. Units that are damaged or improperly installed shall be removed and new units provided as directed.

-- End of Section --

SECTION 09650

RESILIENT FLOORING

07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4078	(1992) Water Emulsion Floor Polish
ASTM E 648	(1994a) Critical Radiant Flux of floor-Covering Systems Using a Radiant Heat Energy Source
ASTM E 662	(1995a) Specific Optical Density of Smoke Generated by Solid Materials
ASTM F 1066	(1995a) Vinyl Composition Floor Tile
ASTM F 1303	(1995) Sheet Vinyl Floor Covering with Backing
ASTM F 1344	(1993) Rubber Floor Tile

FEDERAL SPECIFICATIONS (FS)

FS RR-T-650	(Rev E) Treads, Metallic and Nonmetallic, Skid Resistant
FS SS-T-312	(Rev B; Int Am 1; Notice 1) Tile, Floor: Asphalt, Rubber, Vinyl Vinyl-Asbestos

1.2 FIRE RESISTANCE REQUIREMENTS

Flooring in corridors and exits shall have a minimum average critical radiant flux of 0.22 watts per square centimeter when tested in accordance with ASTM E 648. The smoke density rating shall be less than 450 when tested in accordance with ASTM E 662.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 SD Data

Resilient Flooring and Accessories; FIO.
Manufacturer's descriptive data and installation instructions including cleaning and maintenance instructions.

SD-09 SD Reports

Resilient Flooring and Accessories; FIO.

Copies of test reports showing that representative product samples of the flooring proposed for use have been tested by an independent testing laboratory within the past three years or when formulation change occurred and conforms to the requirements specified.

SD-14 SD Samples

Resilient Flooring and Accessories;FIO;09650

Three samples of each indicated color and type of flooring and base.
Sample size shall be minimum 60 by 100 mm. (2-1/2 by 4 inches.)

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers bearing the manufacturer's name, project identification, and handling instructions. Materials shall be stored in a clean dry area with temperature maintained above 21 degrees C (70 degrees F) for 2 days prior to installation, and shall be stacked according to manufacturer's recommendations. Materials shall be protected from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances.

1.5 ENVIRONMENTAL REQUIREMENTS

Areas to receive resilient flooring shall be maintained at a temperature above 21 degrees C (70 degrees F) and below 38 degrees C (100 degrees F) for 2 days before application, during application and 2 days after application. A minimum temperature of 13 degrees C (55 degrees F) shall be maintained thereafter

1.6 SCHEDULING

Resilient flooring application shall be scheduled after the completion of other work which would damage the finished surface of the flooring.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

1.8 EXTRA MATERIALS

Extra flooring material of each color and pattern shall be furnished at the rate of 5 tiles for each 1000 tiles installed. Extra materials shall be from the same lot as those installed. Extra base material composed of 6 m (20 linear feet) of each color shall be furnished.

PART 2 PRODUCT

2.1 VINYL-COMPOSITION TILE TYPE A

Vinyl-composition tile shall conform to ASTM F 1066, Class 2, (through pattern tile), Composition 1, asbestos-free, and shall be 300 mm (12 inches)

square and 1/8 inch thick. Tile shall have the color and pattern uniformly distributed throughout the thickness of the tile. Flooring in any one continuous area shall be from the same lot and shall have the same shade and pattern.

2.2 RESILIENT BASE

Base shall be manufacturers standard rubber or vinyl, straight style (installed with carpet) coved style (installed with resilient flooring) Base shall be 100 (4 inches) high and a minimum 3mm (1/8 inch) thick. Preformed outside Job Formed corners shall be furnished.

2.3 TRANSITION STRIP

A vinyl or rubber transition strip tapered to meet abutting material shall be provided.

2.4 ADHESIVE

Adhesive for flooring and wall base shall be as recommended by the flooring manufacturer.

2.5 POLISH

Polish shall conform to ASTM D 4078.

2.6 SEALANTS

sealants shall be in accordance with Section 07920 JOINT SEALING.

2.7 MANUFACTURER'S COLOR AND TEXTURE

Color and texture shall be as indicated in drawings

PART 3 EXECUTION

3.1 EXAMINATION/VERIFICATION OF CONDITIONS

The Contractor shall examine and verify that site conditions are in agreement with the design package and shall report all conditions that will prevent a proper installation. The Contractor shall not take any corrective action without written permission from the Government.

3.2 SURFACE PREPARATION

Flooring shall be in a smooth, true, level plane, except where indicated as sloped. Before any work under this section is begun, all defects such as rough or scaling concrete, low spots, high spots, and uneven surfaces shall have been corrected, and all damaged portions of concrete slabs shall have been repaired as recommended by the flooring manufacturer. Concrete curing compounds, other than the type that does not adversely affect adhesion, shall be entirely removed from the slabs. Paint, varnish, oils, release agents, sealers, waxers, and adhesives shall be removed, as recommended by the flooring manufacturer

3.3 MOISTURE TEST

The suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content shall be determined by a moisture test as recommended by the flooring manufacturer.

3.4 INSTALLATION OF VINYL-COMPOSITION TILE

Tile flooring shall be installed with adhesive in accordance with the manufacturer's installation instructions. Tile lines and joints shall be kept square, symmetrical, tight, and even. Edge width shall vary as necessary to maintain full-size tiles in the field, but no edge tile shall be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Flooring shall be cut to, and fitted around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Edge tile shall be cut, fitted, and scribed to walls and partitions after field flooring has been applied.

3.5 INSTALLATION OF RESILIENT BASE

Wall base shall be installed with adhesive in accordance with the manufacturer's written instructions. Base joints shall be tight and base shall be even with adjacent resilient flooring. Voids along the top edge of base at masonry walls shall be filled with caulk.

3.6 CLEANING

Immediately upon completion of installation of tile in a room or an area, flooring and adjacent surfaces shall be cleaned to remove all surplus adhesive. After installation, flooring shall be washed with a cleaning solution, rinsed thoroughly with clear cold water, and, except for raised pattern rubber flooring, rubber tile and sheet rubber flooring, rubber stair treads, and static control vinyl tile, given two coats of polish in accordance with manufacturers written instructions. After each polish coat, floors shall be buffed to an even luster with an electric polishing machine. Raised pattern rubber flooring, rubber tile and sheet rubber flooring, rubber stair treads, and static control vinyl tile shall be cleaned and maintained as recommended by the manufacturer.

3.7 PROTECTION

From the time of laying until acceptance, flooring shall be protected from damage as recommended by the flooring manufacturer. Flooring which becomes damaged, loose, broken, or curled shall be removed and replaced.

-- End of Section --

SECTION 09680

CARPET
07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC TM-16	(1993) Test Method: Colorfastness to Light
AATCC TM-134	(1991) Test Method: Electrostatic Propensity of Carpets
AATCC TM-165	(1993) Test Method: Colorfastness to Crocking: Carpets - AATCC Crockmeter Method
AATCC TM-174	(1993) Test Method: Antimicrobial Activity Assessment of Carpet

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 297	(1993) Rubber Products - Chemical Analysis
ASTM D 418	(1993) Pile Yarn Floor Covering Construction
ASTM D 1423	(1992) Twist in Yarns by the Direct Counting Method
ASTM D 1667	(1976; R 1990) Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam)
ASTM D 3278	(1989) Test Methods for Flash Point of Liquids by Setaflash Closed-Cup Apparatus
ASTM D 3676	(1996) Rubber Cellular Cushion Used for Carpet or Rug Underlay
ASTM E 648	(1996a) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

CARPET AND RUG INSTITUTE (CRI)

CRI 104	(1994) Commercial Carpet Installation Standard
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CODE OF FEDERAL REGULATIONS (CFR)

16 CFR 1630

Standard for the Surface Flammability of
Carpet and Rugs

GERMANY INSTITUTE FOR STANDARDIZATION (DEUTSCHES INSTITUT FÜR
NORMUNG) (DIN)

DIN 54318

(1986) Machine-Made Textile Floor
Coverings; Determination of Dimensional
Changes Due to the Effects of Varied Water
and Heat Conditions; Identical with ISO
2551 Edition 1981

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Carpet and Accessories; FIO.

Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading, and flame resistance characteristics for each type of carpet material and installation accessory.

SD-04 Drawings

Installation; FIO.

Three copies of drawings indicating areas receiving carpet, carpet types, textures and patterns, direction of pile, location of seams, and locations of edge molding.

SD-06 Instructions

Carpet and Accessories; FIO.

Three copies of the manufacturer's printed installation instructions for the carpet, including preparation of substrate, seaming techniques, and recommended adhesives and tapes.

SD-09 Reports

Moisture and Alkalinity Tests; FIO.

Three copies of test reports of moisture and alkalinity content of concrete slab stating date of test, person conducting the test, and the area tested.

SD-13 Certificates

Carpet and Accessories; FIO.

Certificates of compliance from a laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards and Technology attesting that each type of carpet and carpet with cushion

material conforms to the standards specified.

SD-14 Samples

Carpet and Accessories; GA.

- a. Carpet: Two "Production Quality" samples 27 x 18 inches of each carpet proposed for use, showing quality, pattern, and color specified.

SD-19 Operation and Maintenance Manuals

Carpet and Accessories; FIO.

Three copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods, and cleaning cycles.

1.3 REGULATORY REQUIREMENTS

Carpet and adhesives shall bear the Carpet and Rug Institute (CRI) Indoor Air Quality (IAQ) label. Carpet type bearing the label will indicate that the carpet has been tested and meets the criteria of the CRI IAQ Carpet Testing Program, and minimizes the impact on indoor air quality.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, dye lot number, and related information. Materials shall be stored in a clean, dry, well ventilated area, protected from damage and soiling, and shall be maintained at a temperature above 60 degrees F for 2 days prior to installation.

1.5 ENVIRONMENTAL REQUIREMENTS

Areas in which carpeting is to be installed shall be maintained at a temperature above 60 degrees F for 2 days before installation, during installation, and for 2 days after installation. A minimum temperature of 55 degrees F shall be maintained thereafter for the duration of the contract. Traffic or movement of furniture or equipment in carpeted area shall not be permitted for 24 hours after installation. Other work which would damage the carpet shall be completed prior to installation of carpet.

1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one-year period shall be provided.

PART 2 PRODUCTS

2.1 CARPET TYPE

Carpet shall be first quality; free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains, and other physical and manufacturing defects. Carpet materials and treatments shall be reasonably

nonallergenic and free of other recognized health hazards. All grade carpets shall have a static control construction which gives adequate durability and performance.

2.1.1.1 Physical Characteristics

Carpet shall comply with the following:

- a. Carpet Construction: Tufted
- b. Type: Broadloom 12 feet minimum usable carpet width with exception of corridors]
- c. Pile Type: Level-loop .
- d. Pile Fiber: Commercial branded nylon continuous filament .
- e. Pile or Wire Height: Minimum .181 inch in accordance with ASTM D 418.
- f. Yarn Ply: Minimum 2 in accordance with ASTM D 1423.
- g. Gauge or Pitch: Minimum 1/10 inch in accordance with ASTM D 418.
- h. Stitches or Rows/Wires: Minimum per square inch.
- i. Finished Pile Yarn Weight: Minimum ounces per square yard. This does not include weight of backings. Weight shall be determined in accordance with ASTM D 418.
- j. Dye Method: Yarn Dye
- k. Backing Materials: Primary backing materials shall be polypropylene . Secondary backing to suit project requirements shall be those customarily used and accepted by the trade for each type of carpet, except when a special unitary back designed for gluedown is provided.

2.1.2 Performance Requirements

- a. Static Control: Static control shall be provided to permanently control static buildup to less than 3.5 kV when tested at 20 percent relative humidity and 70 degrees F in accordance with AATCC TM-134.
- b. Flammability and Critical Radiant Flux Requirements: Carpet shall comply with 16 CFR 1630. Carpet in corridors and exits shall have a minimum average critical radiant flux of 0.22 watts per square centimeter when tested in accordance with ASTM E 648.
- c. Tuft Bind: Tuft bind force required to pull a tuft or loop free from carpet backing shall be a minimum 9 pound average force for loop pile

2.2 ADHESIVES AND CONCRETE PRIMER

Adhesives and concrete primers for installation of carpet shall be waterproof, nonflammable, meet local air-quality standards, and shall be as recommended by the carpet manufacturer. Seam adhesive shall be waterproof, nonflammable, and nonstaining as recommended by the carpet manufacturer. Release adhesive for modular tile carpet shall be as recommended by the carpet manufacturer. Adhesives flashpoint shall be minimum 140 degrees F in accordance with ASTM D 3278.

2.3 TAPE

Tape for seams shall be as recommended by the carpet manufacturer for the type of seam used in installation.

2.4 COLOR, TEXTURE, AND PATTERN

Color, texture, and pattern shall be in accordance with Section 09915as selected by contractor officer.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Carpet shall not be installed on surfaces that are unsuitable and will prevent a proper installation. Holes, cracks, depressions, or rough areas shall be repaired using material recommended by the carpet or adhesive manufacturer. Floor shall be free of any foreign materials and swept broom clean. Before beginning work, subfloor shall be tested with glue and carpet to determine "open time" and bond.

3.2 MOISTURE AND ALKALINITY TEST

Concrete slab shall be tested for moisture content and excessive alkalinity in accordance with CRI 104. The moisture content shall not exceed a hygrometer reading of 65 percent.

3.3 PREPARATION OF CONCRETE SUBFLOOR

Installation of the carpeting shall not commence until concrete substrate is at least 90 days old. The concrete surfaces shall be prepared in accordance with instructions of the carpet manufacturer. Type of concrete sealer, when required, shall be compatible with the carpet.

3.4 INSTALLATION

Installation shall be in accordance with the manufacturer's instructions and CRI 104. Edges of carpet meeting hard surface flooring shall be protected with molding. Installation shall be in accordance with the molding manufacturer's instructions.

3.4.1 Broadloom Installation

Broadloom carpet shall be installed direct glue down and shall be smooth, uniform, and secure, with a minimum of seams. Seams shall be uniform, unnoticeable, and treated with a seam adhesive. Side seams shall be run toward the light where practical and where such layout does not increase the number of seams. Breadths shall be installed parallel, with carpet

pile in the same direction. Patterns shall be accurately matched. Cutouts, as at door jambs, columns and ducts shall be neatly cut and fitted securely. Seams at doorways shall be located parallel to and centered directly under doors. Seams shall not be made perpendicular to doors or at pivot points. Seams at changes in directions of corridors shall follow the wall line parallel to the carpet direction. Corridors with widths less than 6 feet shall have the carpet laid lengthwise down the corridors.

3.5 CLEANING AND PROTECTION

3.5.1 Cleaning

After installation of the carpet, debris, scraps, and other foreign matter shall be removed. Soiled spots and adhesive shall be removed from the face of the carpet with appropriate spot remover. Protruding face yarn shall be cut off and removed. Carpet shall be vacuumed clean.

3.5.2 Protection

The installed carpet shall be protected from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood, or hardboard sheets. Edges of kraft paper protection shall be lapped and secured to provide a continuous cover. Traffic shall be restricted for at least 45 hours. Protective covering shall be removed when directed by the Contracting Officer.

3.6 REMNANTS

Remnants remaining from the installation, consisting of scrap pieces more than 2 feet in dimension with more than 6 square feet total, shall be provided. Non-retained scraps shall be removed from site.

-- End of Section --

SECTION 09900

PAINTING, GENERAL

07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH-02	(1996) Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 150	(1996) Portland Cement
ASTM D 3273	(1994) Resistance to Growth of Mold on the Surface of Interior Coating in an Environmental Chamber
ASTM D 3274	(1995) Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation
ASTM D 4214	(1989) Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 4258	(1988; R 1992) Surface Cleaning Concrete for Coating

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1500	(Rev A) Sealer, Surface (Latex Block Filler)
CID A-A-1546	(Rev A) Rubbing Varnish
CID A-A-1632	(Basic) Varnish, Asphalt
CID A-A-1788	(Basic) Varnish, Oil: Interior
CID A-A-2246	(Rev A) Paint, Latex (Gloss, Interior)
CID A-A-2247	(Basic) Paint, Latex (Semigloss, Interior)
CID A-A-2248	(Basic) Paint, Latex, (Flat, Interior)

CID A-A-2335	(Basic) Sealer, Surface (Varnish Type, Wood and Cork Floors)
CID A-A-2336	(Rev A) Primer Coating (Alkyd, Exterior Wood, White and Tints)
CID A-A-2339	(Basic) Stain (Wood, Solvent-Dye Type)
CID A-A-2542	(Basic) Sealer, Terrazzo and Concrete Floors, Waterbased
CID A-A-2834	(Rev A) Urethane, Waterborne (Low VOC, Clear)
CID A-A-2867	(Basic) Coating, Polyurethane, Single Component Moisture Cure, Aliphatic
CID A-A-2962	(Basic) Enamel, Alkyd
CID A-A-2994	(Basic) Primer Coating, Interior, for Walls and Wood

FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1	(Rev J) Obstruction Marking and Lighting
------------------	--

FEDERAL SPECIFICATIONS (FS)

FS TT-C-542	(Rev E) Coating, Polyurethane, Oil-Free, Moisture Curing
FS TT-C-555	(Rev B; Am 1) Coating, Textured (for Interior and Exterior Masonry Surfaces)
FS TT-E-2784	(Rev A) Enamel (Acrylic-Emulsion, Exterior Gloss and Semigloss) (Metric)
FS TT-P-28	(Rev G) Paint, Aluminum, Heat Resisting (1200 Degrees F.)
FS TT-S-708	(Rev A; Am 2) Stain, Oil; Semi-Transparent, Wood, Exterior
FS TT-S-001992	(Basic) Stain, Latex, Exterior for Wood Surfaces

MAPLE FLOORING MANUFACTURERS ASSOCIATION (MFMA)

MFMA-03	(1995) Floor Finish List and Specifications for Heavy Duty and Gymnasium Finishes for Maple, Beech and Birch Floors: MFMA Floor Finish List Number 14
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STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 5	(1995) Zinc Dust, Zinc Oxide and Phenolic Varnish Paint
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SSPC Paint 18	(1991) Chlorinated Rubber Intermediate Coat Paint
SSPC Paint 20	(1991) Zinc-Rich Primers (Type I - Inorganic and Type II - Organic)
SSPC Paint 23	(1982) Latex Primer for Steel surfaces
SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)
SSPC SP 1	(1982) Solvent Cleaning
SSPC SP 2	(1995) Hand Tool Cleaning
SSPC SP 3	(1995) Power Tool Cleaning
SSPC SP 6	(1994) Commercial Blast Cleaning
SSPC SP 7	(1994) Brush-Off Blast Cleaning

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Paint; GA.

The names, quantity represented, and intended use for the proprietary brands of materials proposed to be substituted for the specified materials when the required quantity of a particular batch is 50 gallons or less. Regardless of quantities in states where VOC content limitations apply.

SD-06 Instructions

Mixing and Thinning; FIO.

Application;FIO.

Manufacturer's current printed product description, material safety data sheets (MSDS) and technical data sheets for each coating system. Detailed mixing, thinning and application instructions, minimum and maximum application temperature, and curing and drying times between coats for epoxy, moisture-curing polyurethane, and liquid glaze coatings. Detailed application instructions for textured coatings shall be provided.

SD-09 Reports

Paint; GA.

A statement as to the quantity represented and the intended use, plus the

following test report for batches in excess of 50 gallons:

- a. A test report showing that the proposed batch to be used meets specified requirements:

SD-13 Certificates

Lead; FIO. Mildewcide and Insecticide;FIO.
Volatile Organic Compound (VOC) Content;FIO.

Certificate stating that paints for interior use contain no mercurial mildewcide or insecticide. Certificate stating that paints proposed for use contain not more than 0.06 percent lead by weight of the total nonvolatile. Certificate stating that paints proposed for use meet Federal VOC regulations and those of the of the local Air Pollution Control Districts having jurisdiction over the geographical area in which the project is located.

SD-14 Samples

Paint; GA.

While the material is at the site or source of supply, and at a time agreeable to the Contractor and the Contracting Officer, a 1 quart sample of each color and batch, except for quantities of 50 gallons or less, shall be taken by random selection from the sealed containers by the Contractor in the presence of a representative of the Contracting Officer. The contents of the containers to be sampled shall be thoroughly mixed to ensure that the sample is representative. Samples shall be identified by designated name, specification number, manufacturer name and address, batch number, project contract number, intended use, and quantity involved.

1.3 PACKAGING, LABELING, AND STORING

Paints shall be in sealed containers that legibly show the designated name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons. Paints and thinner shall be stored in accordance with the manufacturer's written directions and as a minimum stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors and at temperatures between 40 and 95 degrees F. Paints shall be stored on the project site or segregated at the source of supply sufficiently in advance of need to allow 30 days for testing.

1.4 APPROVAL OF MATERIALS

When samples are tested, approval of materials will be based on tests of the samples; otherwise, materials will be approved based on test reports furnished with them. If materials are approved based on test reports furnished, samples will be retained by the Government for testing should the materials appear defective during or after application. In addition to any other remedies under the contract the cost of retesting defective materials will be at the Contractor's expense.

1.5 ENVIRONMENTAL CONDITIONS

Unless otherwise recommended by the paint manufacturer, the ambient temperature shall be between 45 and 95 degrees F when applying coatings other than water-thinned, epoxy, and moisture-curing polyurethane coatings. Water-thinned coatings shall be applied only when ambient temperature is between 50 and 90 degrees F. Epoxy, and moisture-curing polyurethane coatings shall be applied only within the minimum and maximum temperatures recommended by the coating manufacturer. Moisture-curing polyurethane shall not be applied when the relative humidity is below 30 percent.

1.6 SAFETY AND HEALTH

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in the CONTRACT CLAUSES. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.6.1 Worker Exposures

Exposure of workers to hazardous chemical substances shall not exceed limits established by ACGIH-02, or as required by a more stringent applicable regulation.

1.6.2 Toxic Compounds

Toxic products having ineffective physiological warning properties, such as no or low odor or irritation levels, shall not be used unless approved by the Contracting Officer.

1.6.3 Training

Workers having access to an affected work area shall be informed of the contents of the applicable material data safety sheets (MDSS) and shall be informed of potential health and safety hazard and protective controls associated with materials used on the project. An affected work area is one which may receive mists and odors from the painting operations. Workers involved in preparation, painting and clean-up shall be trained in the safe handling and application, and the exposure limit, for each material which the worker will use in the project. Personnel having a need to use respirators and masks shall be instructed in the use and maintenance of such equipment.

1.6.4 Coordination

Work shall be coordinated to minimize exposure of building occupants, other Contractor personnel, and visitors to mists and odors from preparation, painting and clean-up operations.

PART 2 PRODUCTS

2.1 PAINT

The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, cement-emulsion filler, and other coatings, whether used as prime, intermediate, or finish coat. Paint shall conform to the requirements listed in the painting schedules at the end of this section, except when the required amount of a material of a particular batch is 50 gallons or less, an approved first-line proprietary paint material with similar intended formulation, usage and color to that specified may be used. Additional requirements are as follows:

2.1.1 Colors and Tints

Colors shall be as selected from manufacturer's standard colors, as indicated. Manufacturer's standard color is for identification of color only. Tinting of epoxy and urethane paints shall be done by the manufacturer. Stains shall conform in shade to manufacturer's standard color. The color of the undercoats shall vary slightly from the color of the next coat.

2.1.2 Mildewcide and Insecticide

Paint specified for all coats applied to fabrics and vapor barrier jackets over insulation and surfaces in area shall contain a mildewcide that will not adversely affect the color, texture, or durability of the coating. The mildewcide shall be incorporated into the paint by the manufacturer and shall attain a surface disfigurement rating of 8 or greater when tested in accordance with ASTM D 3273 and evaluated in accordance with ASTM D 3274. Mercurial mildewcide shall not be used in interior paint. Insecticides shall not be used in paint.

2.1.3 Lead

Paints containing lead in excess of 0.06 percent by weight of the total nonvolatile content (calculated as lead metal) shall not be used.

2.1.4 Chromium

Paints containing zinc chromate or strontium chromate pigments shall not be used.

2.1.5 Volatile Organic Compound (VOC) Content

Paints shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards and shall conform to the restrictions of the local air pollution control authority.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS NOT TO BE PAINTED

Items not to be painted which are in contact with or adjacent to painted surfaces shall be removed or protected prior to surface preparation and painting operations. Items removed prior to painting shall be replaced when painting is completed. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Surfaces contaminated by coating materials shall be restored to original condition.

3.2 SURFACE PREPARATION

Surfaces to be painted shall be clean and free of foreign matter before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.2.1 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.3 APPLICATION

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application. Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces. Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

3.3.1 Ventilation

Affected areas shall be ventilated during paint application so that workers exposure to chemical substances shall not exceed limits as established by ACGIH-02, or as required by a more stringent applicable regulation. Interior work zones having a volume of 10,000 cubic feet or less shall be ventilated at a minimum of 2 air exchanges per hour. Ventilation in larger work zones shall be maintained by means of mechanical exhaust. Solvent vapors shall be exhausted outdoors, away from air intakes and workers. Return air inlets in the work zone shall be temporarily sealed before start of work until the coatings have dried.

3.3.2 Respirators

Operators and personnel in the vicinity of operating paint sprayers shall wear respirators.

3.3.3 First Coat

The first coat on plaster, gypsum wallboard, and other surfaces shall include repeated touching up of suction spots or overall application of

primer or sealer to produce uniform color and gloss. Excess sealer shall be wiped off after each application. The first coat on both faces of wood doors shall be applied at essentially the same time. Glazed doors and sashes shall be given the specified coating system within 3 weeks of the time they are glazed, but not before the glazing material has set; paint shall overlay glass about 70 mils all around. Each varnish coat shall be sanded lightly prior to application of subsequent coats.

3.3.4 Timing

Surfaces that have been cleaned, pretreated, and otherwise prepared for painting shall be given a coat of the specified first coat as soon as practical after such pretreatment has been completed, but prior to any deterioration of the prepared surface. Sufficient time shall elapse between successive coats to permit proper drying. This period shall be modified as necessary to suit weather conditions. Oil-based or oleoresinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause the undercoat to lift or lose adhesion. Manufacturer's instructions for application, curing and drying time between coats of two-component systems shall be followed.

3.3.5 Ferrous-Metal Primer

Primer for ferrous-metal shall be applied to ferrous surfaces to receive paint other than asphalt varnish prior to deterioration of the prepared surface. The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

3.4 PIPE COLOR CODE MARKING

Pipes in exposed areas and in accessible pipe spaces shall be provided with color band and titles adjacent to all valves, except those provided at plumbing fixtures, at not more than 40 foot spacing on straight pipe runs, adjacent to change in direction, and on both sides where pipes pass through walls or floors. Color code marking shall be of the color listed in TABLE I and the size listed in TABLE II. The arrows shall be installed adjacent to each band to indicate the direction of flow in the pipe. The legends shall be printed in upper-case black letters as listed in TABLE I. Letter sizes shall be as listed in TABLE II. Marking shall be painted or applied using colored, pressure-sensitive adhesive markers of standard manufacture. Paint shall be as specified for insulated and uninsulated piping.

TABLE I. COLOR CODES FOR MARKING PIPE

Material	Band	Letters and Arrow*	Legend
Cold water (potable) WATER	Green	White	POTABLE
Fire protection water WATER	Red	White	FIRE PR.
Hot water (domestic)	Green	White	H.W.
Hot water recirculating (domestic)	Green	White	H.W.R.
Boiler feed water	Yellow	Black	B.F.

TABLE I. COLOR CODES FOR MARKING PIPE

Material	Band	Letters and Arrow*	Legend
Low temp. water supply (heating)	Yellow	Black	L.T.W.S.
Low temp. water return (heating)	Yellow	Black	L.T.W.R.
Compressed air	Yellow	Black	COMP. AIR
Propane	Blue	White	NAT. GAS
Freon	Blue	White	FREON

TABLE II. COLOR CODE MARKING SIZES

Outside Diameter of Pipe Covering (Inches)	Length of Color Band (inches)	Arrow Length x Width (Inches)	Size of Legend Letters and Numerals (Inches)
Less than 1-1/2	8	8 x 2-1/4	1/2
1-1/2 to 2-3/8	8	8 x 2-1/4	3/4
2-1/2 to 7-7/8	12	8 x 2-1/4	1-1/4
8 to 10	24	12 x 4-1/2	2-1/2
Over 10	32	12 x 4-1/2	3-1/2

3.5 SURFACES TO BE PAINTED

Surfaces listed in the painting schedules at the end of this section, other than those listed in paragraph SURFACES NOT TO BE PAINTED, shall be painted as scheduled.

3.6 SURFACES NOT TO BE PAINTED

Surfaces in the following areas shall not to be painted: sprinkler heads, fire detection devices, deluge valves, items above ceilings not exposed to view. In addition, surfaces of hardware, fittings, and other factory finished items shall not be painted.

3.7 CLEANING

Cloths, cotton waste and other debris that might constitute a fire hazard shall be placed in closed metal containers and removed at the end of each day. Upon completion of the work, staging, scaffolding, and containers shall be removed from the site or destroyed in an approved manner. Paint and other deposits on adjacent surfaces shall be removed and the entire job left clean and acceptable.

3.8 PAINTING SCHEDULES

The following painting schedules identify the surfaces to be painted and prescribe the paint to be used and the number of coats of paint to be applied. Contractor options are indicated by -----or----- between optional systems or coats.

EXTERIOR PAINTING SCHEDULE

<u>Surface</u>	<u>First Coat</u>	<u>Second Coat</u>	<u>Third Coat</u>
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Concrete
masonry units.

Wood, Unless otherwise specified	FS TT-E-2784 Type III	FS TT-E-2784	FS TT-E-2784
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Hardboard: factory primed.	FS TT-E-2784	FS TT-E-2784	None
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Ferrous metal unless otherwise specified	SSPC Paint 23	FS TT-E-2784	FS TT-E-2784
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Gypsum	CID A-A-2994
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	SSPC Paint 23	FS TT-E-2784	FSTT-E-2784
aluminum alloy	Type III	Type I	Type I

Unless other wise	Type I
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-- End of Section --

SECTION 10160

TOILET PARTITIONS

07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

FEDERAL SPECIFICATIONS (FS)

FS RR-P-1352

(Rev C) Partitions, Toilet, Complete

1.2 SYSTEM DESCRIPTION

Toilet partition system, including toilet enclosures, room entrance screens, and urinal screens, shall be a complete and usable system of panels, hardware, and support components. The partition system shall be provided by a single manufacturer and shall be a standard product as shown in the most recent catalog data. The partition system shall be as shown.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Toilet Partition System; FIO.

Manufacturer's technical data and catalog cuts including installation and cleaning instructions.

SD-04 Drawings

Toilet Partition System; FIO.

Drawings showing plans, elevations, details of construction, hardware, reinforcing, fittings, mountings, and anchorings.

SD-14 Samples

Toilet Partition System; GA.

Manufacturer's standard color charts and color samples.

1.4 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand, item identification, and project reference clearly marked. Components shall be stored in a dry location that is adequately ventilated and free from dust, water, or other contaminants and shall have easy access for inspection and handling.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 TOILET ENCLOSURES

Toilet enclosures shall conform to FS RR-P-1352, Type I, Style A. Width, length and height of toilet enclosures shall be as shown. Finish surface of panels shall be baked enamel finish 1 . Provide 2 robe hooks on all partition doors.

2.2 URINAL SCREENS

Urinal screens shall conform to FS RR-P-1352, Type III, Style A . Finish surface of screens shall be baked enamel finish 1 . Width and height of urinal screens shall be as shown.

2.3 HARDWARE

Hardware for the toilet partition system shall conform to FS RR-P-1352 for the specified type and style of partitions. Hardware finish shall be highly resistant to alkalies, urine, and other common toilet room acids.

2.4 COLORS

Color of finishes for toilet partition system components shall be [as specified on drawings.

PART 3 EXECUTION

3.1 INSTALLATION

Toilet partitions shall be installed straight and plumb in accordance with approved manufacturer's instructions with horizontal lines level and rigidly anchored to the supporting construction. Where indicated, anchorage to walls shall be by through-bolting . Drilling and cutting for installation of anchors shall be at locations that will be concealed in the finished work.

3.2 ADJUSTING AND CLEANING

Doors shall have a uniform vertical edge clearance of approximately 3/16 inch and shall rest open at approximately 30 degrees when unlatched. Baked enamel finish shall be touched up with the same color of paint that was used for the finish. Toilet partitions shall be cleaned in accordance with approved manufacturer's instructions and shall be protected from damage

until accepted.

-- End of Section --

SECTION 10440

INTERIOR SIGNAGE

07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

- | | |
|-----------|---|
| AA DAF-45 | (1980) Designation System for Aluminum Finishes |
| AA PK-1 | (1989) Registration Record of Aluminum Association Alloy Designations and Chemical Composition Limits for Aluminum Alloys in the Form of Castings and Ingot |
| AA SAA-46 | (1978) Standards for Anodized Architectural Aluminum |

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

- | | |
|------------|---|
| AAMA 605.2 | (1992; Addenda Jan 1995) Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels |
|------------|---|

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|------------|---|
| ANSI Z97.1 | (1984; Rev 1994) Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings |
|------------|---|

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-------------|---|
| ASTM B 209 | (1996) Aluminum and Aluminum-Alloy Sheet and Plate |
| ASTM B 221 | (1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes |
| ASTM C 1036 | (1991) Flat Glass |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- | | |
|---------|---------------------------------|
| NFPA 70 | (1996) National Electrical Code |
|---------|---------------------------------|

1.2 GENERAL

Interior signage shall be of the sizes and types shown on the drawings, shall conform to the requirements specified herein, and shall be provided at the locations indicated. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation. Signs shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Interior Signage; FIO.

Manufacturer's descriptive data, catalogs cuts, installation and cleaning instructions.

SD-04 Drawings

Interior Signage; FIO.

Drawings showing elevations of each type of sign, dimensions, details and methods of mounting or anchoring, shape and thickness of materials, and details of construction. A schedule showing the location of each sign type shall be included.

SD-14 Samples

Interior Signage; FIO.

One sample of each of the following sign types showing typical quality and workmanship. The samples may be installed in the work, provided each sample is identified and location recorded.

- a. Direction sign.
- b. Door sign.
- c. Building directory.

Two samples of manufacturer's standard color chips for each material requiring color selection.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area.

PART 2 PRODUCTS

2.1 COLOR, FINISH, AND CONTRAST

Color shall be in accordance with Section 09915 COLOR SCHEDULE.

In buildings required to be handicapped-accessible, the characters and background of signs shall be eggshell, matte, or other non-glare finish. Characters and symbols shall contrast with their background - either light characters on a dark background or dark characters on a light background.

2.2 CHARACTER PROPORTIONS AND HEIGHTS

Letters and numbers on signs in handicapped-accessible buildings, which do not designate permanent rooms or spaces, shall have a width-to-height ratio between 3:5 and 1:1 and a stroke-width-to-height ratio between 1:5 and 1:10. Characters and numbers on signs shall be sized according to the viewing distance from which they are to be read. The minimum height is measured using an upper case letter X. Lower case characters are permitted. Suspended or projected overhead signs shall have a minimum character height of 3 inches.

2.3 ALUMINUM ALLOY PRODUCTS

Aluminum extrusions shall be at least 1/8 inch thick, and aluminum plate or sheet shall be at least 0.0508 inch thick. Extrusions shall conform to ASTM B 221; plate and sheet shall conform to ASTM B 209. Where anodic coatings are specified, alloy shall conform to AA PK-1 alloy designation 514.0. Exposed anodized aluminum finishes shall be as shown and shall conform to AA SAA-46.

2.3.1 Anodic Coating

Anodized finish shall conform to AA DAF-45 as follows:

- a. Clear (natural) designation AA-M10-C22-A31, Architectural Class II 0.4 mil or thicker.
- b. Integral color anodized designation AA-M10-C22-A32, Architectural Class 0.4 to 0.7 mil.
- c. Electrolytically deposited color-anodized designation AA-M10-C22-A34, Architectural Class II 0.4 to 0.7 mil.

2.3.2 Organic Coating

Organic coating shall conform to AAMA 605.2, with total dry film thickness not less than 1.2 mils.

2.4 VINYL SHEETING FOR GRAPHICS

Vinyl sheeting for graphics shall be a minimum 0.003 inch film thickness. Film shall include a precoated pressure sensitive adhesive backing.

2.5 ACRYLIC SHEET

Acrylic sheet for panels and components shall conform to ANSI Z97.1.

2.5.1 Door Glazing

Door glazing shall be in accordance with ASTM C 1036, Type 1, Class 1, Quality 3, minimum 1/8 inch thick.

2.5.2 Door Construction

Extruded aluminum door frame shall be of same finish as surrounding frame. Corners shall be mitered , reinforced, and assembled with concealed fasteners. Hinges shall be standard with the manufacturer, in finish to match frames and trim. Glazing shall be set in frame with resilient glazing channels.

2.5.3 Door Locks

Door locks shall be manufacturer's standard, and shall be keyed alike. Lock finish shall match the door finish.

2.5.4 Fabrication

Extruded aluminum frames and trim shall be assembled with corners reinforced and mitered to a hairline fit, with no exposed fasteners.

2.5.5 Illuminated Units

Directory units shall have concealed internal top lighting with rapid start fluorescent tube lamp, internal wiring, and lead at wire for connection. Electrical work shall comply with NFPA 70 and shall be UL or FM listed.

2.6 ANCHORS AND FASTENERS

Exposed anchor and fastener materials shall be compatible with metal to which applied and shall have matching color and finish. Anchorage system shall be of the type recommended by the manufacturer of the indicated substrate. Where recommended by signage manufacturer, foam tape pads may be used for anchorage. Foam tape pads shall be minimum 1/16 inch thick closed cell vinyl foam with adhesive backing. Adhesive shall be transparent, long aging, high tech formulation on two sides of the vinyl foam. Adhesive surfaces shall be protected with a 5 mil green flatstock treated with silicone. Foam pads shall be sized for the signage as per signage manufacturer's recommendations.

2.7 FABRICATION AND MANUFACTURE

2.7.1 Workmanship

Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practicable.

2.7.2 Dissimilar Materials

Where dissimilar metals are in contact, the surfaces will be protected to prevent galvanic or corrosive action.

PART 3 EXECUTION

3.1 INSTALLATION

Signs shall be installed in accordance with approved manufacturer's instructions at locations shown on the drawings. Signs shall be installed plumb and true at mounting heights indicated, and by method shown or specified. Signs which designate permanent rooms and spaces in handicapped-accessible buildings shall be installed on the wall adjacent to the latch side of the door. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting height shall be 60 inches above the finish floor to the centerline of the sign. Mounting location for such signage shall be so that a person may approach within 3 inches of signage without encountering protruding objects or standing within the swing of a door. Signs on doors or other surfaces shall not be installed until finishes on such surfaces have been installed.

3.1.1 Anchorage

Anchorage shall be in accordance with approved manufacturer's instructions. Anchorage not otherwise specified or indicated shall include slotted inserts, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood.

3.1.2 Protection and Cleaning

The work shall be protected against damage during construction. Hardware and electrical equipment shall be adjusted for proper operation. Glass, frames, and other sign surfaces shall be cleaned in accordance with the manufacturer's approved instructions.

-- End of Section --

SECTION 10800

TOILET ACCESSORIES

07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 1036 (1991) Flat Glass

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-2380 (Basic) Dispenser, Paper Towel

CID A-A-2398 (Rev B) Curtain, Shower and Window (Metric
- SI)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Finishes; FIO. Accessory Items; FIO.

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, and operation instructions.

1.3 DELIVERY, STORAGE, AND HANDLING

Toilet accessories shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area protected from construction damage and vandalism.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Toilet accessories shall be provided where indicated in accordance with the schedule on the drawings. Porcelain type, tile-wall accessories are

specified in Section 09310 CERAMIC TILE. Each accessory item shall be complete with the necessary mounting plates, shall be of sturdy construction with corrosion resistant surface.

2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall be suited for use with the supporting construction. Exposed fasteners shall be of tamperproof design and shall be finished to match the accessory.

2.1.2 Finishes

Except where noted otherwise, finishes on metal shall be provided as follows:

Metal	Finish
Stainless steel	No. 4 satin finish
Carbon steel, copper alloy, and brass	Chromium plated, bright

2.2 ACCESSORY ITEMS

Accessory items shall conform to the requirements specified .

2.2.1 Paper Towel Dispenser (PTD)

Paper towel dispenser shall conform to CID A-A-2380, Type I , shall be constructed of not less than

0.269 inch Type 304 stainless steel, and shall be surface recessed mounted. Dispenser shall have a towel compartment and a mirror door and liquid soap dispenser. Locking mechanism shall be tumbler key lock .

2.2.2 Sanitary Napkin Disposer (SND)

Sanitary napkin disposal shall be constructed of Type 304 stainless steel with removable leak-proof receptacle for disposable liners. Fifty disposable liners of the type standard with the manufacturer shall be provided. Receptacle shall be retained in cabinet by tumbler lock. Disposer shall be provided with a door for inserting disposed napkins, and shall be partition mounted, double access .

2.2.3 Sanitary Napkin and Tampon Dispenser (SNTD)

Sanitary napkin and tampon dispenser shall be surface mounted . Dispenser, including door shall be Type 304 stainless steel and shall dispense both napkins and tampons with a minimum capacity of 20 each. Dispensing mechanism shall be for coin operation. Coin mechanisms shall be field changeable by adjusting pins for new coin designation. Coin mechanisms shall have minimum denominations of 25 cents. Doors shall be hung with a full-length corrosion-resistant steel piano hinge and secured with a tumbler lock. Keys for coin box shall be different from the door keys.

2.2.4 Toilet Tissue Dispenser (TTD)

Toilet tissue holder shall be Type II - surface mounted with two rolls of tissue mounted horizontally . Cabinet shall be stainless steel, satin finish.

2.2.5 Waste Receptacle (WR)

Waste receptacle shall be Type 304 stainless steel, designed for surface mounting. Reuseable liner, of the type standard with the receptacle manufacturer, shall be provided. Capacity shall be not less than 12 cubic feet. Receptacles with push doors and doors for access to the waste compartment shall have continuous hinges.

PART 3 EXECUTION

3.1 INSTALLATION

Toilet accessories shall be securely fastened to the supporting construction in accordance with the manufacturer's approved instructions. Accessories shall be protected from damage from the time of installation until acceptance.

-- End of Section --

SECTION 13120

STANDARD METAL BUILDING SYSTEMS
07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

- | | |
|-----------|---|
| AA-01 | (1993) Aluminum Standards and Data |
| AA SAS-30 | (1986) Aluminum Construction Manual Series
- Section 1 Specifications for Aluminum
Structures |

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

- | | |
|----------|--|
| AAMA 101 | (1993) Voluntary Specifications for
Aluminum and Poly (Vinyl Chloride) (PVC)
Prime Windows and Sliding Glass Doors |
|----------|--|

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

- | | |
|-------------|---|
| AISC FCD-90 | (1990) AISC Quality Certification Program
Description |
| AISC-S303 | (1992) Code of Standard Practice for Steel
Buildings and Bridges |
| AISC-S329 | (1986) Allowable Stress Design
Specification for Structural Joints Using
ASTM A 325 or ASTM A 490 Bolts |
| AISC-S335 | (1989) Specification for Structural Steel
Buildings - Allowable Stress Design and
Plastic Design |

AMERICAN IRON AND STEEL INSTITUTE (AISI)

- | | |
|-------------|--|
| AISI SG-673 | (1987) Cold-Formed Steel Design Manual |
|-------------|--|

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-----------|---|
| ASTM A 36 | (1994a) Carbon Structural Steel |
| ASTM A 53 | (1993a) Pipe, Steel, Black and Hot-Dipped,
Zinc-Coated Welded and Seamless |

ASTM A 252	(1993) Welded and Seamless Steel Pipe Piles
ASTM A 325	(1994) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 446	(1993) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
ASTM A 463	(1994) Steel Sheet, Aluminum-Coated by the Hot-Dip Process
ASTM A 490	(1993) Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
ASTM A 500	(1993) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	(1993) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 529	(1994) High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A 570	(1992; R 1993) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
ASTM A 572	(1994b) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 588	(1994) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
ASTM A 606	(1991a; R 1993) Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A 607	(1992a) Steel, Sheet and Strip, High-Strength, Low-Alloy, Columbium or Vanadium, or Both, Hot-Rolled and Cold-Rolled
ASTM A 618	(1993) Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
ASTM A 792	(1993a) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process, General Requirements
ASTM B 117	(1994) Operating Salt Spray (Fog) Testing
ASTM B 209	(1993) Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 221	(1993) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM B 241	(1995) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B 308	(1995) Aluminum-Alloy 6061-T6 Standard Structural Shapes
ASTM B 429	(1992a) Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM C 518	(1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C 553	(1992) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 612	(1993) Mineral Fiber Block and Board Thermal Insulation
ASTM C 1289	(1995) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D 522	(1993a) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(1989; R 1993) Specular Gloss
ASTM D 714	(1987; R 1994) Evaluating Degree of Blistering of Paints
ASTM D 968	(1993) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D 1308	(1987; R 1993) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2244	(1993) Calculation of Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(1994) Testing Water Resistance of Coatings in 100 % Relative Humidity
ASTM D 2794	(1993) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(1995) Measuring Adhesion by Tape Test

ASTM D 3841	(1992) Glass-Fiber-Reinforced Polyester Plastic Panels
ASTM D 4214	(1989) Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 4397	(1991) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E 84	(1994a) Surface Burning Characteristics of Building Materials
ASTM E 96	(1994) Water Vapor Transmission of Materials
ASTM E 1042	(1992) Acoustically Absorptive Materials Applied by Trowel or Spray
ASTM G 23	(1995) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1994) Structural Welding Code - Steel
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MATERIAL HANDLING INSTITUTE (MHI)

MHI CMAA 70	(1994) Electric Overhead Traveling Cranes
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METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA-01	(1986; Errata; Supple 1990) Low Rise Building Systems Manual
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SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA-1013	(1993) Architectural Sheet Metal Manual
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STEEL DOOR INSTITUTE (SDOI)

SDOI SDI-100	(1991) Standard Steel Doors and Frames
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STEEL WINDOW INSTITUTE (SWI)

SWI-01	(1989) The Specifier's Guide to Steel Windows
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UNDERWRITERS LABORATORIES (UL)

UL 580	(1994; Rev thru Apr 1995) Tests for Uplift Resistance of Roof Assemblies
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1.2 GENERAL

1.2.1 Building Configuration

Buildings shall have vertical walls and gable roofs. Roof slope shall be as indicated. Buildings shall be single-span structures with one of the following framing systems: self-framing, column with single-span or continuous trusses, continuous beam frames, column with rigid frame, or rigid frame (tapered beam or plate girder). Building dimensions shall be as standard with the manufacturer and not less than those indicated, but exceeding the indicated dimensions only by the amount of the closest standard size thereto. Eave height shall be measured from the top of the finished floor to the intersection of the insides of the roof and sidewall sheets. The clear opening between the finished floor and the bottom of the roof steel shall be as indicated.

1.2.2 Manufacturer

Metal building shall be the product of a recognized metal building systems manufacturer who has been in the practice of manufacturing metal buildings for a period of no less than 5 years. The manufacturer shall be chiefly engaged in the practice of designing and fabricating metal building systems. The manufacturer shall have an AISC Quality Certification, category MB in accordance with AISC FCD-90.

1.2.3 Installer

Erector shall have specialized experience in the erection of metal building systems for a period of at least 3 years.

1.3 DESIGN REQUIREMENTS

1.3.1 Design Conditions

Loading combinations and definitions shall be in accordance with MBMA-01. Loading criteria as set out by MBMA-01 shall apply.

1.3.1.1 Dead Load

The dead load shall consist of the weight of the structural frame and all other materials of the building system.

1.3.1.2 Collateral Loads

Collateral load of pounds per square foot shall be applied to the entire structure to account for the weight of additional permanent materials other than the building system, such as sprinklers, mechanical systems, electrical systems, hung partitions, and ceilings. This allowance does not include the weight of hung equipment weighing 50 pounds or more. Equipment loads of 50 pounds or more shall be investigated and the structure (frame, purlins, girts) shall be strengthened as required. The Contractor is responsible for providing the building manufacturer the magnitude and approximate location of all concentrated loads greater than 50 pounds.

1.3.1.3 Roof Live Loads

Roof live loads shall be determined and applied in accordance with MBMA-01.

1.3.1.4 Wind Loads

Wind pressures shall be computed and applied in accordance with MBMA-01 unless otherwise shown or directed by the Contracting Officer.

1.3.1.5 Auxiliary Loads

Auxiliary (dynamic live) loads such as superimposed loads resulting from building machinery, craneways, and vehicles shall be as shown in the drawings. The Contractor shall verify that the auxiliary loads shown on the drawings exceed the loads imposed by the equipment supplied.

1.3.1.6 Concentrated Loads

Concentrated loads shall be applied at locations indicated on the drawings.

1.3.1.7 Seismic Loads

Seismic loads shall be computed for seismic zone 1 in accordance with MBMA-01 using an importance factor of 1.15

1.3.2 Foundation Requirements

Foundations shall be designed for an allowable soil bearing pressure of (300 pounds per square foot),, a minimum bottom of footing depth of 2.51 feet below finish floor elevation, a factor of safety of 1.5 for overturning, sliding and uplift, and a concrete compressive strength as specified in Section 03300 CONCRETE FOR BUILDING CONSTRUCTION.

1.3.3 Framing and Structural Members

Structural steel members and their connections shall be designed in accordance with AISC-S335. Structural cold-formed steel framing members and their connections shall be designed in accordance with AISI SG-673. Aluminum structural members and their connections shall be designed in accordance with AA SAS-30. Framed openings shall be designed to structurally replace the covering and framing displaced. The allowable live load deflection of roof elements shall not exceed 1/180th of the span. Members with openings in their webs shall be designed with consideration of the additional stresses which will result due to the openings. Deflections of the steel framing above and along the side of rolling door openings shall be limited to a maximum of 1/2 of the allowable movement in the telescoping top roller of the doors to ensure proper operation of the doors.

1.3.4 Exterior Covering

Except as otherwise specified, steel covering shall be designed in accordance with AISI SG-673. Aluminum covering shall be designed in accordance with the AA-01. Section modulus and moment of inertia of aluminum sheet shall be determined for actual cross section dimensions by the conventional methods for actual design stresses and by effective width concept for deflection in accordance with AA SAS-30. Maximum deflection for wall and roof panels under full dead and live and/or wind loads shall not exceed 1/180th of the span between supports. The design analysis shall establish that the roof when deflected under dead plus live or snow loads, will not result in a negative gradient. Maximum deflections shall be based

on sheets continuous across two or more supports with sheets unfastened and fully free to deflect. In addition to the loads indicated above, the roof decking shall be designed for a 200 pound concentrated load at midspan on a 12 inch wide section of deck. Panels thinner than 0.03 inches are not permitted for diaphragms used to resist seismic loads in Seismic Zones 2 through 4 or to resist crane loads. The methods for resisting lateral loads shall be cross-bracing, rigid frames, or wind columns.

1.3.5 Gutters And Downspouts

Gutters and downspouts shall be designed according to the requirements of SMACNA-1013 for storms which should be exceeded only once in 5 years and with adequate provisions for thermal expansion and contraction. Supports for gutters and downspouts shall be designed for the anticipated loads.

1.3.6 Louvers

Louvers shall be fixed blade type, size as indicated in drawings.

1.3.7 Continuous Ventilators

Continuous roof ventilators shall be ridge mounted gravity type, with dampers, as indicated on drawings.

1.3.8 Drift Provision

Lateral deflections, or drift at the roof level of a structure in relation to the floor or slab on grade, caused by deflection of horizontal force resisting elements shall conform to MBMA-01. Masonry walls shall be anchored to the steel framing.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Design Analysis; FIO.

Design analysis as one package with the detail drawings. The design analysis signed by a Registered Professional Engineer shall include a list of the design loads, and complete calculations for the building, its components, and the foundations. Formulas and references shall be identified. Assumptions and conclusions shall be explained, and cross-referencing shall be clear. The design analysis shall include, but not be limited to, the following wind and seismic information:

- a. Wind forces on various parts of the structure. Both positive and negative pressures shall be calculated with the controlling pressure summarized.
- b. Lateral forces due to seismic loading.

Computer programmed designs shall be accompanied by stress values and a

letter of certification, signed by a Registered Professional Engineer, stating the design criteria and procedures used and attesting to the adequacy and accuracy of the design. A narrative of the computer program delineating the basic methodology shall be included in the submittal. The program output shall be annotated and supplemented with sketches to make it easier for an engineer unfamiliar with the program to verify the input and output. Critical load conditions used in the final sizing of the members shall be emphasized. The design analysis shall include the name and office phone number of the designer and checker who function as a point of contact to answer questions during the detail-drawing review.

SD-04 Drawings

Metal Building Systems; GA.

Detail drawings consisting of catalog cuts, design and erection drawings containing an isometric view of the roof showing the design wind uplift pressure and dimensions of edge and corner zones; shop painting and finishing specifications, instruction manuals, manufacturer's recommended erection methods and procedures and other data as necessary to clearly describe design, material, sizes, layouts, construction details, fasteners, and erection. Manufacturer's recommended erection methods and procedures shall describe the basic sequence of assembly, temporary bracing, shoring, and related information necessary for erection of the metal building including its structural framework and components. A brief list of locations where buildings of similar design have been used shall be included with the detail drawings and shall include information regarding date of installation, name and address of owner, and how the structure is used.

SD-08 Statements

Qualifications; FIO.

Qualifications of the manufacturer, and qualifications and experience of the building erector.

SD-13 Certificates

Metal Building Systems; FIO.

A Certificate from the metal building manufacturer stating that the metal building was designed from a complete set of the contract drawings and specifications and that the building furnished complies with the specified requirements.

Mill certification for structural bolts, framing steel, wall and roof covering, and wall liner panels.

Insulation; FIO.

Certificate attesting that the polyurethane or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

SD-14 Samples

Accessories; FIO.

One sample of each type of flashing, trim, closure, cap and similar items. Size shall be sufficient to show construction and configuration.

Roof and Wall Covering; GA.

One piece of each type and finish (exterior and interior) to be used, 9 inches long, full width. The sample for factory color finished covering shall be accompanied by certified laboratory test reports showing that the sheets to be furnished are produced under a continuing quality control program and that a representative sample consisting of not less than 5 pieces has been tested and has met the quality standards specified for factory color finish.

Fasteners; FIO.

Two samples of each type to be used, with statement regarding intended use. If so requested, random samples of bolts, nuts, and washers as delivered to the jobsite shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

Insulation; FIO.

One piece of each type to be used, and descriptive data covering installation.

Gaskets and Insulating Compounds; FIO.

Two samples of each type to be used and descriptive data.

Sealant; FIO.

One sample, approximately 1 pound, and descriptive data.

1.5 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials other than framing and structural members shall be covered with weathertight coverings and kept dry. Storage accommodations for roof and wall covering shall provide good air circulation and protection from surface staining.

1.6 GUARANTEE

The metal building system shall be guaranteed against water leaks arising out of or caused by ordinary wear and tear by the elements for a period of 20 years. Such guarantee shall start upon final acceptance of the work or the date the Government takes possession, whichever is earlier.

PART 2 PRODUCTS

2.1 BUILDING COMPONENTS

Each piece or part of the assembly shall be clearly and legibly marked to

correspond with the detail drawings.

2.2 FRAMING AND STRUCTURAL MEMBERS

Steel 1/8 inch or more in thickness shall conform to ASTM A 36, ASTM A 529, ASTM A 572, or ASTM A 588. Uncoated steel less than 1/8 inch in thickness shall conform to ASTM A 570, ASTM A 606, or ASTM A 607. Galvanized steel shall conform to ASTM A 446, G 90 coating designation, 0.045 inch minimum thickness. Aluminum-zinc coated steel shall conform to ASTM A 792, AZ 55 coating designation, 0.045 inch minimum thickness. Aluminum sheet shall conform to ASTM B 209, 0.032 inch minimum thickness. Aluminum structural shapes and tubes shall conform to ASTM B 221, or ASTM B 308. Structural pipe shall conform to ASTM A 53, ASTM A 252, ASTM A 500, ASTM A 501, ASTM A 618, ASTM B 221, ASTM B 241 or ASTM B 429. Holes for bolts shall be made in the shop.

2.3 ROOF AND WALL COVERING

Panels shall be either steel or aluminum and shall have a factory color finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope or the entire height of any unbroken wall surface. Width of sheets with overlapping configurations shall provide not less than

24 inches of coverage in place, and those with interlocking ribs shall provide not less than 12 inches of coverage in place. Design provisions shall be made for thermal expansion and contraction consistent with the type of system to be used. All sheets shall be square cut, except gable end wall sheets may be cut in the shop to correspond to the roof slope and may have a horizontal joint at the eave line.

2.3.1 Roof Panels

Roof Panels shall have configurations for overlapping sheets. Roof deck assemblies shall be Class 90 as defined in UL 580. System for securing the roof covering to structural framing members shall be exposed, penetrating fastener type. The ridge cap shall not have exposed fasteners. Height of corrugation at overlap of adjacent roof sheets shall be [the building manufacturer's standard for the indicated roof slope

2.3.2 Wall Panels

Wall panels shall have configurations for overlapping adjacent sheets or interlocking ribs for securing adjacent sheets. Wall covering shall be fastened to framework using concealed fasteners.

2.3.3 Steel Covering

Zinc-coated steel conforming to ASTM A 446, G 90 coating designation; aluminum-zinc alloy coated steel conforming to ASTM A 792. AZ 55 coating; or aluminum-coated steel conforming to ASTM A 463, Type 2, coating designation T2 65. Panels shall be 0.024 inch thick minimum, except that when the mid field of the roof is subject to design wind uplift pressures of 60 psf or greater or the steel covering is used as a diaphragm the entire roof system shall have a minimum thickness of 0.030 inch.

2.3.4 Aluminum Covering

Alloy conforming to ASTM B 209, temper as required for the forming

operation, minimum 0.032 inch thick.

2.3.5 Factory Color Finish

Wall and roof panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on fluoropolymer enamel topcoat with an appropriate prime coat. Color shall match the color indicated on the drawings. The exterior coating shall be a nominal

1 mil thickness consisting of a polyvinylidene fluoride topcoat of not less than 0.7 mil dry film thickness and the paint manufacturer's recommended primer of not less than 0.2 mil thickness. The interior color finish shall consist of a 0.2 mil thick prime coat. The exterior color finish shall meet the test requirements specified below.

2.3.5.1 Salt Spray Test

A sample of the sheets shall withstand a salt spray test for a minimum of 1000 hours in accordance with ASTM B 117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 8F, few No. 8 blisters, as determined by ASTM D 714; and a rating of 6, 1/8 inch failure at scribe, as determined by ASTM D 1654.

2.3.5.2 Formability Test

When subjected to testing in accordance with ASTM D 522, the coating film shall show no evidence of fracturing to the naked eye.

2.3.5.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested a minimum of 1000 hours in accordance with ASTM G 23, using a Type EH apparatus with cycles of 60 minutes radiation and 60 minutes condensing humidity. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with tape in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. For sheets required to have a low gloss finish, the chalk rating shall be not less than No. 6 and the color difference shall be not greater than 7 units.

2.3.5.4 Humidity Test

When subjected to a humidity cabinet in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

2.3.5.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in

accordance with ASTM D 2794 equal to 1.5 times metal thickness in mils, expressed in inch pounds, with no loss of adhesions.

2.3.5.6 Abrasion Resistant Test

When subjected to the falling sand test in accordance with ASTM D 968, the coating system shall withstand a minimum of 50 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

2.3.5.7 Pollution Resistance

Coating shall show no visual effects when immersion tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

2.3.6 Accessories

Flashing, trim, metal closure strips and curbs, fascia, caps, diverters, and similar metal accessories shall be not less than the minimum thickness specified for covering. Accessories shall be compatible with the system furnished. Exposed metal accessories shall be finished to match the covering building finish. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the covering and shall not absorb or retain water.

2.4 FASTENERS

Fasteners for steel wall and roof panels shall be zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for aluminum wall and roof panels shall be aluminum or corrosion resisting steel. Fasteners for structural connections shall provide both tensile and shear strength of not less than 750 pounds per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be gasketed or have gasketed washers on the exterior side of the covering to waterproof the fastener penetration. Washer material shall be compatible with the covering; have a minimum diameter of 3/8 inch for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 1/8 inch thick. When wall covering is factory color finished, exposed wall fasteners shall be color finished or provided with plastic color caps to match the covering. Nonpenetrating fastener system using concealed clips shall be manufacturer's standard for the system provided.

2.4.1 Screws

Screws shall be as recommended by the manufacturer to meet the strength design requirements of the panels.

2.4.2 End-Welded Studs

Automatic end-welded studs shall be shouldered type with a shank diameter of not less than 3/16 inch and cap or nut for holding covering against the shoulder.

2.4.3 Explosive Actuated Fasteners

Fasteners for use with explosive actuated tools shall have a shank diameter of not less than 0.145 inch with a shank length of not less than 1/2 inch for fastening panels to steel and not less than 1 inch for fastening panels to concrete.

2.4.4 Blind Rivets

Blind rivets shall be aluminum with 3/16 inch nominal diameter shank or stainless steel with 1/8 inch nominal diameter shank. Rivets shall be threaded stem type if used for other than the fastening of trim. Rivets with hollow stems shall have closed ends.

2.4.5 Bolts

Bolts shall be not less than 1/4 inch diameter, shouldered or plain shank as required, with proper nuts.

2.5 GUTTERS AND DOWNSPOUTS

Gutters and downspouts shall be fabricated of aluminum, zinc-coated steel or aluminum-zinc alloy coated steel and shall have manufacturer's standard factory color finish. Minimum uncoated thickness of materials shall be 0.018 inch for steel and 0.032 inch for aluminum. All accessories necessary for the complete installation of the gutters and downspouts shall be furnished. Accessories shall include gutter straps, downspout elbows, downspout straps and fasteners fabricated from metal compatible with the gutters and downspouts.

2.6 LOUVERS

Louvers shall be fabricated of aluminum, zinc-coated steel, or aluminum-zinc alloy coated steel; shall have manufacturer's standard factory color finish; and shall be furnished with insect screens. Minimum uncoated thickness of materials shall be 0.048 inch for steel and 0.064 inch for aluminum. Manually operated louvers shall be designed to be opened and closed from the operating floor.

2.7 CIRCULAR ROOF VENTILATORS

Circular roof ventilators shall be fabricated of aluminum or zinc-coated steel; shall have manufacturer's standard factory color finish, and shall be furnished with insect screens. Minimum uncoated thickness of materials shall be 0.018 inch for steel and 0.032 inch for aluminum. Ventilators shall be designed to provide rigid weathertight construction upon installation, free from vibration and movement.

2.8 CONTINUOUS ROOF VENTILATORS

Continuous roof ventilators shall be fabricated of aluminum, zinc-coated steel, or aluminum-zinc alloy coated steel, shall have manufacturer's standard factory color finish, and shall be furnished with insect screens and chain or cable operated dampers. Minimum uncoated thickness of materials shall be 0.018 inch for steel and 0.032 inch for aluminum. Ventilators shall be furnished in 8 to 10 feet long sections braced at midlength.

2.9 DOORS

2.9.1 Hinged Doors

Hinged doors and frames shall conform to the requirements of Section 08110 STEEL DOORS AND FRAMES. Exterior doors shall have top edges closed flush and sealed against water penetration. Hardware shall be as scheduled on the drawings and as specified in Section 08700 BUILDERS' HARDWARE.

2.9.2 Overhead Doors

Overhead doors shall be as specified in Section 08331, Overhead Rolling Doors. All hardware necessary for the complete installation of the doors shall be furnished. Accessories shall include galvanized steel track, brackets, lifting handles, torsion-spring mechanism, ball bearing rollers, cylinder lock, and weatherstripping. Doors shall be electric motor operated.

2.10 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown on the contract drawings. R-values shall be determined at a mean temperature of 75 degrees F in accordance with ASTM C 518. Insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Blanket insulation shall have a facing as specified in paragraph VAPOR RETARDER. Insulation, including facings, shall have a flame spread not in excess of 25 and a smoke developed rating not in excess of 50 when tested in accordance with ASTM E 84. The stated R-value of the insulation shall be certified by an independent Registered Professional Engineer if tests are conducted in the insulation manufacturer's laboratory.

2.10.1 Blanket Insulation

Blanket insulation shall conform to ASTM C 553.

2.10.2 Insulation Retainers

Retainers shall be type, size and design necessary to adequately hold the insulation and to provide a neat appearance. Metallic retaining members shall be nonferrous or have a nonferrous coating. Nonmetallic retaining members, including adhesives used in conjunction with mechanical retainers or at insulation seams, shall have a fire resistance classification not less than that permitted for the insulation.

2.11 SEALANT

Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable building color and shall cure to a rubberlike consistency. Concealed sealant may be the nonhardening type.

2.12 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds

shall be nonrunning after drying.

2.13 VAPOR RETARDER

2.13.1 Vapor Retarders as Integral Facing

Insulation facing shall have a permeability of 0.1perm or less when tested in accordance with ASTM E 96. Facing shall be white. Facings and finishes shall be factory applied.

2.13.2 Vapor Retarders Separate from Insulation

Vapor retarder material shall be polyethylene sheeting conforming to the requirements of ASTM D 4397. A single ply of 10 mil polyethylene sheet; or, at the option of the Contractor, a double ply of 6 mil polyethylene sheet shall be used. A fully compatible polyethylene tape shall be provided which has equal or better water vapor control characteristics than the vapor retarder material. A cloth industrial duct tape in a utility grade shall also be provided to use as needed to protect the vapor retarder from puncturing.

2.14 SHOP PRIMING

Ferrous surfaces shall be cleaned of oil, grease, loose rust, loose mill scale, and other foreign substances and shop primed. Primer coating shall be in accordance with the manufacturer's standard system.

PART 3 EXECUTION

3.1 ERECTION

3.1.1 General

Erection shall be in accordance with the approved erection instructions and drawings and with applicable provision of AISC-S335. The completed buildings shall be free of excessive noise from wind-induced vibrations under the ordinary weather conditions to be encountered at the location where the building is erected, and meet all specified design requirements. Dissimilar materials which are not compatible when contacting each other shall be insulated from each other by means of gaskets or insulating compounds. Framing members fabricated or modified on site shall be saw or abrasive cut; bolt holes shall be drilled. On-site flame cutting of framing members, with the exception of small access holes in structural beam or column webs, shall not be permitted. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, sheets with an excess of such holes or with such holes in critical locations shall not be used. Improper or mislocated bolt holes in structural members or other misfits caused by improper fabrication or erection, shall be repaired in accordance with AISC-S303. Exposed surfaces shall be kept clean and free from sealant, metal cuttings, excess material from thermal cutting, and other foreign materials. Exposed surfaces which have been thermally cut shall be finished smooth within a tolerance of 1/8 inch. Stained, discolored or damaged sheets shall be removed from the site. Welding of steel shall conform to AWS D1.1; welding of aluminum shall conform to AA SAS-30. High-strength bolting shall conform to AISC-S329 using ASTM A 325 or ASTM A 490 bolts. Concrete work is specified in Section 03300 CONCRETE FOR BUILDING CONSTRUCTION.

3.1.2 Framing and Structural Members

Anchor bolts shall be accurately set by template while the concrete is in a plastic state. Uniform bearing under base plates and sill members shall be provided using a nonshrinking grout when necessary. Members shall be accurately spaced to assure proper fitting of covering. Separate leveling plates under column base plates shall not be used. As erection progresses, the work shall be securely fastened to resist the dead load and wind and erection stresses. Supports for electric overhead traveling cranes shall be positioned and aligned in accordance with MHI CMAA 70.

3.1.3 Wall Covering and Roof Covering

Wall covering shall be applied with the longitudinal configurations in the vertical position. Roof covering shall be applied with the longitudinal configurations in the direction of the roof slope. Accessories shall be fastened into framing members, except as otherwise approved. Closure strips shall be provided as indicated and where necessary to provide weathertight construction.

3.1.3.1 Lap Type Panels with Exposed Fasteners

Except for self-framing buildings, end laps shall be made over framing members with fasteners into framing members approximately 2 inches from the end of the overlapping sheet. Side laps shall be laid away from the prevailing winds. Side lap distances, end lap distances, joint sealing, and spacing and fastening of fasteners shall be in accordance with the manufacturer's standard practice insofar as the maximum spacings specified are not exceeded and provided such standard practice will result in a structure which will be free from water leaks and meet design requirements. Spacing of fasteners shall present an orderly appearance and shall not exceed: 8 inches on center at end laps of covering, 12 inches on center at connection of covering to intermediate supports, 12 inches on center at side laps of roof coverings, and 18 inches on center at side laps of wall coverings except when otherwise approved. Side laps and end laps of roof and wall covering and joints at accessories shall be sealed. Fasteners shall be installed in straight lines within a tolerance of 1/2 inch in the length of a bay. Fasteners shall be driven normal to the surface and to a uniform depth to properly seat the gasketed washers.

3.1.3.2 Concealed Fastener Wall Panels

Panels shall be fastened to framing members with concealed fastening clips or other concealed devices standard with the manufacturer. Spacing of fastening clips and fasteners shall be in accordance with the manufacturer's written instructions insofar as the maximum fastener spacings specified are not exceeded and provided such standard practice will result in a structure which will be free from water leaks and meet design requirements. Spacing of fasteners and anchor clips along the panel interlocking ribs shall not exceed 12 inches on center except when otherwise approved. Fasteners shall not puncture covering sheets except as approved for flashing, closures, and trim; exposed fasteners shall be installed in straight lines. Interlocking ribs shall be sealed according to manufacturer's recommendations. Joints at accessories shall be sealed.

3.1.4 Gutters and Downspouts

Gutters and downspouts shall be rigidly attached to the building. Spacing

of cleats for gutters shall be 16 inches maximum. Spacing of brackets and spacers for gutters shall be 36 inches maximum. Supports for downspouts shall be spaced according to manufacturer's recommendations.

3.1.5 Louvers and Ventilators

Louvers and ventilators shall be rigidly attached to the supporting construction in a manner to assure a rain-tight installation.

3.1.6 Doors

Doors , including frames and hardware, shall be securely anchored to the supporting construction, shall be installed plumb and true, and shall be adjusted as necessary to provide proper operation. Joints at doors shall be sealed according to manufacturer's recommendations to provide weathertight construction.

3.1.7 Vapor Retarder Installation

3.1.7.1 Integral Facing on Blanket Insulation

Integral facing on blanket insulation shall have the facing lapped and sealed with a compatible tape to provide a vapor tight membrane.

3.1.7.2 Polyethylene Vapor Retarder

The polyethylene vapor retarder membrane shall be installed over the entire surface. A fully compatible polyethylene tape shall be used to seal the edges of the sheets to provide a vapor tight membrane. Sheet edges shall be lapped not less than 6 inches. Sufficient material shall be provided to avoid inducing stresses in the sheets due to stretching or binding. All tears or punctures that are visible in the finished surface at any time during the construction process shall be sealed with polyethylene tape.

3.2 FIELD PAINTING

Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Shop-primed ferrous surfaces exposed on the outside of the building and all shop-primed surfaces of doors and windows shall be painted with two coats of an approved exterior enamel. Factory color finished surfaces shall be touched up as necessary with the manufacturer's recommended touch-up paint.

-- End of Section --

SECTION 15250
THERMAL INSULATION FOR MECHANICAL SYSTEMS
07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. At the discretion of the government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167	(1996) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 580	(1995a) Stainless and Heat-Resisting Steel Wire
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 195	(1990) Mineral Fiber Thermal Insulating Cement
ASTM C 449	(1995) Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C 533	(1985; R 1990) Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 534	(1994) Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C 547	(1995) Mineral Fiber Pipe Insulation
ASTM C 552	(1991) Cellular Glass Thermal Insulation
ASTM C 553	(1992) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 612	(1993) Mineral Fiber Block and Board Thermal Insulation
ASTM C 647	(1995) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation

ASTM C 795	(1992) Thermal Insulation for Use in Contact With Austenitic Stainless Steel
ASTM C 871	(1995) Test Methods for Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions
ASTM C 916	(1985; Rev 1990) Adhesives for Duct Thermal Insulation
ASTM C 920	(1994) Elastomeric Joint Sealants
ASTM C 921	(1989 R; 1996) Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM C 1126	(1989; R 1994) Specification for faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
ASTM D 3278	(1989) Test Methods for Flash Point of Liquids by Setaflash Closed-Cup Apparatus
ASTM E 84	(1996a) Surface Burning Characteristics of Building Materials
ASTM E 96	(1995) Water Vapor Transmission of Materials
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application

MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)

MICA-01	(1993) National Commercial & Industrial Insulation Standards
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1.2 SYSTEM DESCRIPTION

Field-applied insulation and accessories on mechanical systems shall be as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated.

1.3 GENERAL QUALITY CONTROL

1.3.1 Standard Products

Materials shall be the standard products of manufacturers regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.3.2 Installer's Qualifications

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

1.3.3 Surface Burning Characteristics

Unless otherwise specified, insulation not covered with a jacket shall have a flame spread rating no higher than 75 and a smoke developed rating no higher than 150. The outside surface of insulation systems which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread rating no higher than 25 and a smoke developed rating no higher than 50. Insulation materials located exterior to the building perimeter are not required to be fire-rated. Flame spread and smoke developed ratings shall be determined by ASTM E 84. Insulation shall be tested in the same density and installed thickness as the material that shall be used in the actual construction. Jackets shall comply with the flame spread and smoke developed ratings of 25/50 as determined by ASTM E 84.

1.3.4 Identification of Materials

Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-14 Samples

Thermal Insulation Materials; GA

A complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories for each mechanical system requiring insulation shall be included. Materials furnished under this section of the specification shall be submitted at one time.

After approval of materials and prior to applying insulation a booklet shall be prepared and submitted for approval. The booklet shall contain marked-up MICA-01 plates (or detail drawings showing the insulation material and insulating system) for each pipe, duct, or piece of equipment which is/are required to be insulated per this specification. The MICA plates shall be marked-up showing the materials to be installed in accordance with the requirements of this specification for the specific insulation application. The Contractor shall submit all MICA Plates required to show the entire insulating system, including Plates required to show insulation penetrations, vessel bottom and top heads, legs, and skirt insulation as applicable. If the Contractor elects to submit detailed drawings instead of marked-up MICA Plates, the detail drawings shall show cut-away, section views, and details indicating each component of the insulation system and showing provisions for insulating jacketing, and sealing portions of the equipment. For each type of insulation

installation on the drawings, provide a label which identifies each component in the installation (i.e., the duct, insulation, adhesive, vapor retarder, jacketing, tape, mechanical fasteners, etc.) Indicate insulation by type and manufacturer. Three copies of the booklet shall be submitted at the jobsite to the Contracting Officer. One copy of the approved booklet shall remain with the insulation Contractor's display sample and two copies shall be provided for Government use.

After approval of materials actual sections of installed systems properly insulated in accordance with the specification requirements shall be displayed. Such actual sections must remain accessible to inspection throughout the job and will be reviewed from time to time for controlling the quality of the work throughout the construction site. Each material used shall be identified, by indicating on an attached sheet the specification requirement for the material and the material by each manufacturer intended to meet the requirement. Display sample sections will be inspected at the jobsite by the Contracting Officer. Approved display sample sections shall remain on display at the jobsite during the construction period. Upon completion of construction, the display sample sections will be closed and sealed.

Pipe Insulation Display Sections: Display sample sections shall include as a minimum an elbow or tee, a valve, dielectric unions and flanges, a hanger with protection shield and insulation insert, or dowel as required, at support point, method of fastening and sealing insulation at longitudinal lap, circumferential lap, butt joints at fittings and on pipe runs, and terminating points for each type of pipe insulation used on the job, and for hot pipelines and cold pipelines, both interior and exterior, even when the same type of insulation is used for these services.

1.5 STORAGE

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants by the Contractor. Insulation material and supplies that become dirty, dusty, wet, or otherwise contaminated may be rejected by the Contracting Officer.

PART 2 PRODUCTS

2.1 GENERAL MATERIALS

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either the wet or dry state. Materials to be used on stainless steel surfaces shall meet ASTM C 795 requirements. Materials shall be asbestos free and conform to the following:

2.1.1 Adhesives

2.1.1.1 Acoustical Lining Insulation Adhesive

Insulation shall be applied in cut-to-size pieces attached to the interior of the duct with a nonflammable, fire-resistant adhesive conforming to ASTM C 916, Type I. Exposed edges of the liner at the duct ends and at other joints where the lining will be subject to erosion shall be coated with a heavy brush coat of the nonflammable, fire-resistant adhesive to prevent

delamination of glass fibers.

2.1.1.2 Mineral Fiber Insulation Cement

Cement shall be in accordance with ASTM C 195.

2.1.1.3 Lagging Adhesive

Lagging adhesives shall be nonflammable and fire-resistant and shall have flame spread and smoke developed ratings of 25/50 when measured in accordance with ASTM E 84. Adhesives shall be either the Class 1 or Class 2 type as defined here. Class 1 adhesive shall be pigmented white and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bounding fibrous glass tape to joints of fibrous glass board; or for bonding lagging cloth to thermal insulation. Class 2 adhesive shall be pigmented white and be suitable for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations.

2.1.2 Contact Adhesive

Adhesive may be dispersed in a nonhalogenated organic solvent with a low flash point flash point less than minus 25 degrees F when tested in accordance with ASTM D 3278 or, dispersed in a nonflammable organic solvent which shall not have a fire point below 200 degrees F. The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not omit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to 212 degrees F. The adhesive shall be nonflammable and fire resistant.

2.1.3 Caulking

ASTM C 920, Type S, Grade NS, Class 25, Use A.

2.1.4 Corner Angles

Nominal 0.016 inch aluminum 1 x 1 inch with factory applied kraft backing. Aluminum shall be ASTM B 209, Alloy 3003, 3105, or 5005.

2.1.5 Finishing Cement

Mineral fiber hydraulic-setting thermal insulating cement ASTM C 449.

2.1.6 Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth and glass tape shall have flame spread and smoke developed ratings of no greater than 25/50 when measured in accordance with ASTM E 84. Fibrous glass cloth and tape; 20 x 20 maximum size mesh. Tape shall be 4 inch wide rolls. Class 3 tape shall be 4.5 ounces per square yard.

2.1.7 Staples

Outward clinching type ASTM A 167, Type 304 or 316 stainless steel.

2.1.8 Jackets

ASTM C 921, Type I, maximum moisture vapor transmission 0.02 perms, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is acceptable. Minimum tensile strength, 35 pound/inch width. ASTM C 921, Type II, minimum puncture resistance 25 Beach units, tensile strength minimum 20 pound/inch width. Jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing.

2.1.8.1 White Vapor Retarder ASJ (All Service Jacket)

For use on hot/cold pipes, ducts, or equipment. Vapor retarder jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing.

2.1.8.2 Aluminum Jackets

Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.016 inch nominal thickness; ASTM B 209, Temper H14, Temper H16, Alloy 3003, 5005, or 3105 with factory applied moisture retarder. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.015 inch thick, 1/2 inch wide for pipe under 12 inch diameter and 3/4 inch wide for pipe over 12 inch diameter. Aluminum jacket circumferential seam bands shall be 2 x 0.016 inch aluminum matching jacket material. The jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburgh or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place.

2.1.8.3 Polyvinyl Chloride (PVC) Jackets

Polyvinyl chloride (PVC) jacket and fitting covers shall have high impact strength, UV resistant rating or treatment and moderate chemical resistance with minimum thickness 0.030 inch. Insulation under PVC jacket shall meet jacket manufacturer's written recommendations.

2.1.9 Vapor Retarder Coating

The vapor retarder coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall not exceed 0.05 perm and shall be determined according to procedure B of ASTM E 96 utilizing apparatus described in ASTM E 96. The coating shall be a nonflammable, fire resistant type. The flash point of the compound shall not be less than 80 degrees F and shall be determined in accordance with ASTM D 3278. All other application and service properties shall be in accordance with ASTM C 647.

2.1.10 Wire

Soft annealed ASTM A 580 Type 302, 304 or 316 stainless steel, 16 or 18

gauge.

2.2 PIPE INSULATION MATERIALS

Pipe insulation materials shall be as follows:

2.2.1 Aboveground Cold Pipeline

Insulation for minus 30 degrees to Plus 60 degrees F shall be as follows:

2.2.1.1 Cellular Glass

ASTM C 552, Type II, and Type III.

2.2.1.2 Flexible Cellular Insulation

ASTM C 534, Type I or II. Type II shall have vapor retarder skin on both sides of the insulation.

2.2.1.3 Phenolic Insulation

ASTM C 1126, Type III. A maximum allowable leachable chloride content shall comply with ASTM C 795 when tested in accordance with ASTM C 871.

2.2.2 Aboveground Hot Pipeline

For aboveground hot pipeline above 60 degrees F insulation the following requirements shall be met.

2.2.2.1 Mineral Fiber

ASTM C 547, Class 1 or Class 2 as required for the operating temperature range.

2.2.2.2 Cellular Glass

ASTM C 552, Type II and Type III.

2.2.2.3 Flexible Cellular Insulation

ASTM C 534, Type I or II to 200 degrees F service.

2.3 DUCT INSULATION MATERIALS

Duct insulation materials shall be as follows:

2.3.1 Rigid Mineral Fiber

ASTM C 612, Class 1.

2.3.2 Flexible Mineral Fiber

ASTM C 553, Type I, Class B-2.

2.3.3 Cellular Glass

ASTM C 552, Type I.

2.3.4 Phenolic Foam

ASTM C 1126 Type II. A maximum allowable leachable chloride content shall comply with ASTM C 795 when tested in accordance with ASTM C 871.

2.3.5 Flexible Cellular

ASTM C 534 Type II.

2.4 EQUIPMENT INSULATION MATERIALS

2.4.1 Hot Equipment Insulation

For temperatures above 60 degrees F.

2.4.1.1 Rigid Mineral Fiber

ASTM C 612, Type 2, 3, 4 or 5 as required for temperature encountered to 1800 degrees F.

2.4.1.2 Flexible Mineral Fiber

ASTM C 553, Type 1, 2, 3, 4, 5, 6, or 7 as required for temperature encountered to 1200 degrees F.

2.4.1.3 Calcium Silicate

ASTM C 533, Type I, indoors only, or outdoors above 250 degrees F. Pipe shape may be used on diesel engine exhaust piping and mufflers to 1200 degrees F.

2.4.1.4 Cellular Glass

ASTM C 552, Type I, Type III, or Type IV as required.

2.4.1.5 Flexible Cellular Insulation

ASTM C 534, Type II, to 200 degrees F.

2.4.1.6 Phenolic Foam

ASTM C 1126 Type II to 250 degrees F. A maximum allowable leachable chloride content shall comply with ASTM C 795 when tested in accordance with ASTM C 871.

PART 3 EXECUTION

3.1 APPLICATION - GENERAL

3.1.1 Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of this

specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if aforementioned cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA-01 standard plates except where modified herein or on the drawings.

3.1.2 Fire stopping

Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with Fire stopping materials as specified in Section 07270 FIRE STOPPING.

3.1.3 Painting and Finishing

Painting shall be as specified in Section 09900 PAINTING, GENERAL.

3.1.4 Flexible Cellular Insulation

Flexible cellular insulation shall be installed with seams and joints sealed with a contact adhesive. Flexible cellular insulation shall not be used on surfaces greater than 200 degrees F. Seams shall be staggered when applying multiple layers of insulation.

3.1.5 Welding

No welding shall be done on piping, duct or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

3.1.6 Pipes/Ducts/Equipment which Require Insulation

Insulation is required, unless stated otherwise, on all pipes, ducts, or equipment, which operate at or below 60 F and at or above 80 F.

3.2 PIPE INSULATION INSTALLATION

3.2.1 Pipe Insulation

3.2.1.1 General

Pipe insulation shall be installed on aboveground hot and cold pipeline systems as specified below to form a continuous thermal retarder, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

- a. Pipe used solely for fire protection.

- b. Chromium plated pipe to plumbing fixtures. However, fixtures for use by the physically handicapped shall have the hot water supply and drain, including the trap, insulated where exposed.
- c. Sanitary drain lines.
- d. Unions in pipe above 60 degrees F.
- e. Strainers in pipe above 60 degrees F.
- f. Check valves in pipe above 60 degrees F.
- g. Air chambers.

3.2.1.2 Pipes Passing Through Sleeves

- a. Pipe insulation shall be continuous through the sleeve.
- b. An aluminum jacket with factory applied moisture retarder shall be provided over the insulation wherever penetrations require sealing.
- c. Where penetrating interior walls, the aluminum jacket shall extend 2 inches beyond either side of the wall and shall be secured on each end with a band.
- d. In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, aluminum jackets shall be utilized. Pipe insulation to the 5 ft level shall be protected.

3.2.1.3 Pipes Passing Through Walls

- a. For hot water pipes supplying lavatories or other similar heated service which requires insulation, the insulation shall be terminated on the backside of the finished wall. The insulation termination shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch applied with glass tape embedded between coats (if applicable). The coating shall extend out onto the insulation 2 inches and shall seal the end of the insulation. Glass tape seams shall overlap 1 inch. Caulk the annular space between the pipe and wall penetration. Cover the pipe and wall penetration with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration at least 3/8 inch.
- b. For domestic cold water pipes requiring insulation, the insulation shall be terminated on the finished side of the wall (i.e. insulation must cover the pipe throughout the wall penetration). The insulation shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch. The coating shall extend out onto the insulation 2 inches and shall seal the end of the insulation. Caulk the annular space between the pipe and wall penetration. Cover the pipe and wall penetration with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration by at least 3/8 inch.

3.2.1.4 Flexible Cellular Pipe Insulation

Flexible cellular pipe insulation shall be tubular form for pipe sizes 6 inches and less. Seams shall be staggered when applying multiple layers of insulation. Sweat fittings shall be insulated with miter-cut pieces the same size as on adjacent piping. Screwed fittings shall be insulated with sleeved fitting covers fabricated from miter-cut pieces and shall be overlapped and sealed to the adjacent pipe insulation.

3.2.2 Aboveground Cold Pipelines

The following shall be included for aboveground cold pipelines minus 30 degrees to plus 60 degrees F:

- a. Make-up water.
- b. Refrigerant suction lines.
- c. Air conditioner condensate drains.

3.2.2.1 Insulation Thickness

Insulation thickness for cold pipelines shall be determined using Table I.

Table I - Cold Piping Insulation Thickness
Pipe Size (inches)

Type of Service	Material	Runouts up to 2 in*	1 in & less	1.25 - 2 in	2.5 - 4 in	5 - 6 in	8 in & larger
Refrigerant suction piping	CG		1.5	1.5	1.5	1.5	1.5
	FC		1.0	1.0	1.0	1.0	1.0
	PF		1.0	1.0	1.0	1.0	1.0]
Cold domestic water, above and below ceilings	CG	1.5	1.5	1.5	1.5	1.5	1.5
	FC	3/8	3/8	3/8	3/8	3/8	3/8
	PF	3/8	3/8	3/8	3/8	3/8	3/8
Air conditioning condensate drain located inside building	FC		3/8	0.5	0.5	N/A	N/A
	PF		3/8	3/8	3/8	N/A	N/A

LEGEND:

PF - Phenolic Foam
CG - Cellular Glass
CS - Calcium Silicate
MF - Mineral Fiber
FC - Flexible Cellular

3.2.2.2 Jacket for Fibrous, Cellular Glass, and Phenolic Foam Insulated Pipe

Insulation shall be covered with a factory applied vapor retarder jacket or field applied seal welded PVC jacket. The aluminum jacket shall be

installed as specified for piping exposed to weather, except sealing of the laps of the aluminum jacket is not required. In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, aluminum jackets shall be utilized. Pipe insulation to the 5 ft level will be protected.

3.2.2.3 Insulation for Straight Runs (Fibrous, Cellular Glass and Phenolic Foam)

- a. Insulation shall be applied to the pipe with joints tightly butted. The ends of fibrous insulation shall be sealed off with vapor retarder coating at intervals not to exceed 15 feet.
- b. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches. Butt strips 3 inches wide shall be provided for circumferential joints.
- c. Laps and butt strips shall be secured with adhesive and stapled on 4 inch centers if not factory self-sealing.
- d. Factory self-sealing lap systems may be used when the ambient temperature is between 40 degrees and 120 degrees F during installation. The lap system shall be installed in accordance with manufacturer's recommendations. Stapler shall be used only if specifically recommended by the manufacturer. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.
- e. All Staples, including those used to repair factory self-seal lap systems, shall be coated with a vapor retarder coating. All seams, except those on factory self-seal systems shall be coated with vapor retarder coating.
- f. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and securing it with adhesive, stapling, and coating with vapor retarder coating. The patch shall extend not less than 1-1/2 inches past the break.
- g. At penetrations such as thermometers, the voids in the insulation shall be filled and sealed with vapor retarder coating.

3.2.2.3 Insulation for Fittings and Accessories

- a. Pipe insulation shall have ends thoroughly coated with a vapor retarder coating not less than 6 inches from each flange, union, valve, anchor, or fitting in all directions.
- b. Precut, preformed insulation for placement over fittings, flanges, unions, valves, anchors, and mechanical couplings shall be used. Precut, preformed insulation shall exhibit the same properties as the adjoining pipe insulation. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation should be overlapped 2 inches or one pipe diameter. Loose fill mineral fiber or insulating cement shall be used to fill the voids. Elbows

insulated using segments shall not have less than 3 segments per elbow.

- c. Upon completion of installation of insulation on flanges, unions, valves, anchors, fittings and accessories, terminations and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with two coats of vapor retarder coating with a minimum total thickness of 1/16 inch, applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. The coating shall extend out onto the adjoining pipe insulation 2 inches.
- d. Flexible connections at pumps and other equipment shall be insulated with 1/2 inch flexible cellular insulation, unless otherwise indicated.
- e. Insulation shall be marked showing the location of unions, strainers, and check valves.

3.2.2.4 Optional PVC Fitting Covers

At the option of the Contractor, premolded, one or two piece PVC fitting covers may be used in lieu of the vapor retarder and embedded glass tape. Factory premolded insulation segments shall be used under the fitting covers for elbows. Insulation segments shall be the same thickness as adjoining pipe insulation and the insulation shall be protected with one coat of vapor retarder coating under the PVC cover. The covers shall be secured by PVC vapor retarder tape, adhesive, seal-welding or with tacks made for securing PVC covers. Seams in the cover, and tacks and laps to adjoining pipe insulation jacket, shall be sealed with vapor retarder tape to ensure that the assembly has a continuous vapor seal.

3.2.3 Aboveground Hot Pipelines

For hot pipelines above 60 degrees F the following shall be included:

- a. Domestic hot water.
- b. Hot water heating.

3.2.3.1 Insulation Thickness

Insulation thickness for hot pipelines shall be determined using Table II.

LEGEND:

PF - Phenolic Foam
CG - Cellular Glass
CS - Calcium Silicate
MF - Mineral Fiber
FC - Flexible Cellular

Table II - Hot Piping Insulation Thickness
Pipe Size (inches)

Type of Service	Runouts up to	1 in &	1.25 - 2	2.5 - 4	5 - 6	8 in &
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Table II - Hot Piping Insulation Thickness
Pipe Size (inches)

Type of Service (degrees F)	Material	Runouts up to 2 in	1 in & less	1.25 - 2 in	2.5 - 4 in	5 - 6 in	8 in & larger
(degrees F)	Material	2 in	less	in	in	in	larger
Hot domestic water supply & recirculating system (200 F max)	CG	1.5	1.5	1.5	1.5	1.5	1.5
	FC	0.5	1.0	1.0	1.5	1.5	1.5
	PF	0.5	1.0	1.0	1.0	1.0	1.0
	MF	0.5	1.0	1.0	1.5	1.5	1.5
[Heating hot water, supply & return (250 F max)]	CG	1.5	1.5	2.0	2.0	2.0	2.5
	PF	0.5	1.0	1.0	1.0	1.0	1.5
	MF	0.5	1.5	1.5	2.0	2.5	3.0
	CS	1.0	1.5	2.0	2.5	2.5	2.5]

3.2.3.2 Jacket for Insulated Pipe

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type II jacket or field applied aluminum where required or seal welded PVC.

3.2.3.3 Insulation for Straight Runs

- Insulation shall be applied to the pipe with joints tightly butted.
- Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches, and butt strips 3 inches wide shall be provided for circumferential joints.
- Laps and butt strips shall be secured with adhesive and stapled on 4 inch centers if not factory self-sealing. Adhesive may be omitted where pipe is concealed.
- Factory self-sealing lap systems may be used when the ambient temperature is between 40 degrees and 120 degrees F and shall be installed in accordance with manufacturer's instructions. Laps and butt strips shall be stapled whenever there is nonadhesion of the system. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.
- Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and be secured with adhesive and stapled on 4 inch centers if not factory self-sealing. Adhesive may be omitted where pipe is concealed. Patch shall extend not less than 1-1/2 inches past the break.
- Install flexible cellular pipe insulation by slitting tubular sections and applying onto piping or tubing. Alternately, whenever possible, slide unslit sections over the open ends of piping or

tubing. All seams and butt joints shall be secured and sealed with adhesive. When using self seal products only the butt joints shall be secured with adhesive. Insulation shall be pushed on the pipe, never pulled. Stretching of insulation may result in open seams and joints. All edges shall be clean cut. Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp knives must be used.

3.2.3.4 Insulation for Fittings and Accessories

- a. The run of the line pipe insulation shall have the ends brought up to the item.
- b. Insulation of the same thickness and conductivity as the adjoining pipe insulation, either premolded or segmented, shall be placed around the item abutting the adjoining pipe insulation, or if nesting size insulation is used, overlapping 2 inches or one pipe diameter. Loose fill mineral fiber or insulating cement shall be used to fill the voids. Insulation for elbows less than 3 inch size shall be premolded. Insulation for elbows 3 inch size and larger shall be either premolded or segmented. Elbows insulated using segments shall have not less than 3 segments per elbow. Insulation may be wired or taped on until finish is applied.
- c. Upon completion of installation of insulation on flanges, unions, valves, anchors, fittings and accessories, terminations and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with two coats of Class 1 adhesive applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. Adhesive shall extend onto the adjoining insulation not less than 2 inches. The total dry film thickness shall be not less than 1/16 inch.
- d. Insulation terminations shall be tapered to unions at a 45-degree angle.
- e. At the option of the Contractor, factory premolded one- or two-piece PVC fitting covers may be used in lieu of the adhesive and embedded glass tape. Factory premolded segments or factory or field cut blanket insert insulation segments shall be used under the cover and shall be the same thickness as adjoining pipe insulation. The covers shall be secured by PVC vapor retarder tape, adhesive, seal-welding or with tacks made for securing PVC covers.

3.3 DUCT INSULATION INSTALLATION

Except for oven hood exhaust duct insulation, corner angles shall be installed on external corners of insulation on ductwork in exposed finished spaces before covering with jacket.

3.3.1 Duct Insulation Thickness

Duct insulation thickness shall be in accordance with Table III.

Table III - Minimum Duct Insulation (mm)

Table III - Minimum Duct Insulation (mm)

Cold Air Ducts	50
Fresh Air Intake Ducts	38
Warm Air Ducts	50

Table III - Minimum Duct Insulation (inches)

Cold Air Ducts	2.0
Fresh Air Intake Ducts	1.5
Warm Air Ducts	2.0

3.3.2 Insulation and Vapor Retarder for Cold Air Duct

Insulation and vapor retarder for cold air duct below 60 degrees F: Ducts and associated equipment shall be insulated to a thickness which is in accordance with Table III. The following shall be insulated:

- a. Supply ducts.
- b. Return air ducts.
- c. Fresh air intake ducts.
- d. Ducts exposed to weather.
- e. Combustion air intake ducts.

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 3/4 pcf and rigid type where exposed, minimum density 3 pcf. Insulation for round/oval ducts shall be flexible type, minimum density 3/4 pcf with a factory Type I jacket; or, a semi rigid board, minimum density 3 pcf, formed or fabricated to a tight fit, edges beveled and joints tightly butted and staggered, with a factory applied Type I all service jacket. Insulation for exposed ducts shall be provided with either a white, paintable, factory-applied Type I jacket or a vapor retarder jacket coating finish as specified. Fibrous and cellular glass insulation on concealed duct shall be provided with a factory-applied Type I vapor retarder jacket. The total dry film thickness shall be approximately 1/16 inch. Duct insulation shall be continuous through sleeves and prepared openings except fire wall penetrations. Duct insulation terminating at fire dampers, shall be continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air and which may be prone to condensate formation. Duct insulation and vapor retarder shall cover the collar, neck, and any uninsulated surfaces of diffusers, registers and grills. Vapor retarder materials shall be applied to form a complete unbroken vapor seal over the insulation.

3.3.2.1 Installation on Exposed Duct Work

- a. For rectangular ducts, rigid insulation shall be secured to the duct by mechanical fasteners on all four sides of the duct, spaced not more than 12 inches apart and not more than 3 inches from the

edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 12 inches and larger. One row shall be provided for each side of duct less than 12 inches.

- b. Duct insulation shall be formed with minimum jacket seams. Each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projections is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over. Vapor retarder jacket shall be continuous across seams, reinforcing, and projections. When height of projections is greater than the insulation thickness, insulation and jacket shall be carried over.
- c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and the pin trimmed and bent over.
- d. Joints in the insulation jacket shall be sealed with a 4 inch wide strip of the same material as the vapor retarder jacket. The strip shall be secured with Class 2 adhesive and stapled. Staples and seams shall be sealed with a brush coat of vapor retarder coating.
- e. Breaks and ribs or standing seam penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 2 inches beyond the break or penetration and shall be secured with Class 2 adhesive and stapled. Staples and joints shall be sealed with a brush coat of vapor retarder coating.
- f. At jacket penetrations such as hangers, thermometers, and damper operating rods, the voids in the insulation shall be filled and the penetrations sealed with a brush coat of vapor retarder coating.
- g. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish. The coating shall overlap the adjoining insulation and uninsulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.
- h. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation with minimum density of $3/4$ pcf attached by applying Class 2 adhesive around the entire perimeter of the duct in 6 inch wide stripe on 12 inch centers.

3.3.3 Insulation for Warm Air Duct

For warm air ducts above 60 degrees F, ducts and associated equipment shall be insulated to a thickness which is in accordance with Table III. The following shall be insulated:

- a. Supply ducts.

Insulation for rectangular ducts shall be flexible type where concealed, minimum density $3/4$ pcf; and rigid type where exposed, minimum density 3 pcf. Flexible type insulation shall be used for round ducts, minimum density $3/4$ pcf with a factory-applied Type II jacket. Class 1 adhesive finish where indicated to be used shall be accomplished by applying two

coats of Class 1 adhesive with a layer of glass cloth embedded between the coats. The total dry film thickness shall be approximately 1/16 inch. Duct insulation shall be continuous through sleeves and prepared openings. Duct insulation shall terminate at fire dampers and flexible connections.

3.3.3.1 Installation on Concealed Duct

- a. For rectangular, oval and round ducts, insulation shall be attached by applying Class 2 adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.
- b. For rectangular and oval ducts 24 inches and larger, insulation shall be secured to the bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corner.
- c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corners.
- d. The insulation shall be impaled on the mechanical fasteners where used and shall be pressed thoroughly into the adhesive. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type hangers.
- e. Self-locking washers shall be installed where mechanical fasteners are used and the pin trimmed and bent over.
- f. Insulation jacket shall overlap not less than 2 inches at joints and the lap shall be secured with Class 2 adhesive under the lap and stapled on 4 inch centers.

3.3.4 Insulation for Evaporative Cooling Duct

Evaporative cooling supply duct located in spaces not evaporatively cooled, shall be insulated. Material and installation requirements shall be as specified for duct insulation for warm air duct.

3.3.5 Duct Test Holes

After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

3.3.6 Duct Exposed to Weather

3.3.6.1 Installation

Ducts exposed to weather shall be insulated and finished as specified for the applicable service for exposed duct inside the building. After the above is accomplished, the insulation shall then be further finished as detailed in the following subparagraphs.

3.3.6.2 Rectangular Ducts

Two coats of weatherproof mastic shall be applied to the entire surface with a layer of glass cloth embedded between coats. Glass cloth overlaps at joints and adjoining surfaces shall be not less than 2 inches. Each coat of weatherproof mastic shall be 1/16 inch minimum thickness. The top of the exterior duct work shall be built up with insulation in such a manner as to ensure a positive drain of any rain water which may appear. The minimum pitch of the built up section shall be in accordance with the recommendation of the manufacturer of the vapor retarder/weatherproof mastic. Care should be taken in the construction of the built up section so that no low areas appear; this shall ensure no "pooling" of water on the vapor retarder which leads to premature degradation of the retarder and subsequent deterioration of the insulation.

3.4 EQUIPMENT INSULATION INSTALLATION

3.4.1 General

Removable insulation sections shall be provided to cover parts of equipment which must be opened periodically for maintenance including vessel covers, fasteners, flanges and accessories. Equipment insulation shall be omitted on the following:

- a. Handholes.
- b. Boiler manholes.
- c. Cleanouts.
- d. ASME stamps.
- e. Manufacturer's nameplates.

3.4.2 Insulation for Hot Equipment

Hot equipment above 60 degrees F: Insulation shall be furnished on equipment handling media above 60 degrees F including the following:

- a. Pumps handling media above 130 degrees F.

3.4.2.1 Insulation of Pumps

Pumps shall be insulated by forming a box around the pump housing. The box shall be constructed by forming the bottom and sides using joints which do not leave raw ends of insulation exposed. Bottom and sides shall be banded to form a rigid housing which does not rest on the pump. Joints between top cover and sides shall fit tightly. The top cover shall have a joint forming a female shiplap joint on the side pieces and a male joint on the top cover, thus making the top cover removable. Two coats of Class I adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. A parting line shall be provided between the box and the removable sections allowing the removable sections to be removed without disturbing the insulation coating. The total dry thickness of the finish shall be 1/16 inch. Caulking shall be applied to parting line of the removable sections and penetrations.

-- End of Section --

SECTION 15320
FIRE PUMPS
07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1990b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 193	(1992) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194	(1992a) Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM A 795	(1990) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B 42	(1993) Seamless Copper Pipe, Standard Sizes
ASTM B 88	(1993) Seamless Copper Water Tube
ASTM B 135	(1991b) Seamless Brass Tube
ASTM C 533	(1985; R 1990) Calcium Silicate Block and Pipe Thermal Insulation
ASTM F 436	(1992) Hardened Steel Washers

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.3	(1992) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.5	(1988; Errata; B16.5a) Pipe Flanges and Flanged Fittings

ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1991) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.39	(1986) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(1992) Hypochlorites
AWWA B301	(1992) Liquid Chlorine
AWWA C110	(1987) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids
AWWA C111	(1990) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	(1991) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C500	(1986) Gate Valves for Water and Sewerage Systems
AWWA C651	(1992) Disinfecting Water Mains

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825	(1993; Supple I, II, & III) Approval Guide
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FEDERAL SPECIFICATIONS (FS)

FS TT-E-489	(Rev H) Enamel, Alkyd, Gloss, Low Voc Content
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MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(1987) Bronze Gate, Globe, Angle and Check Valves
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MILITARY SPECIFICATIONS (MS)

MS MIL-T-27730	(Rev A) Tape, Antiseize, Polytetrafluoroethylene, with Dispenser
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NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(1993) Motors and Generators
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 20	(1993) Installation of Centrifugal Fire Pumps
NFPA 24	(1992) Installation of Private Fire Service Mains and Their Appurtenances
NFPA 37	(1994) Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 70	(1993) National Electrical Code
NFPA 1963	(1993) Screw Threads and Gaskets for Fire Hose Connections

UNDERWRITERS LABORATORIES (UL)

UL 04	(1993; Supple) Fire Protection Equipment Directory
UL 80	(1987; Rev thru Apr 1993) Steel Inside Tanks for Oil-Burner Fuel
UL 142	(1993) Steel Aboveground Tanks for Flammable and Combustible Liquids
UL 262	(1988; Rev Mar 1991) Gate Valves for Fire-Protection Service
UL 448	(1984; Rev thru Sep 1990) Pumps For Fire Protection Service
UL 789	(1987; Rev thru Sep 1990) Indicator Posts for Fire - Protection Service
UL 1247	(1989) Diesel Engines For Driving Centrifugal Fire Pumps

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Product

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation at least 2

years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the jobsite.

1.2.2 Description

Fire pump, piping and associated equipment shall be provided complete and ready for operation. The fire pump shall be horizontal centrifugal fire pump. The fire pump shall be electric motor driven fire pump. Fire pump, appurtenances and installation shall conform to NFPA 20, unless more stringent requirements are specified herein or are indicated on the drawings. In NFPA 20, the advisory provisions including those listed in the appendix shall be considered mandatory; reference to the authority having jurisdiction shall be interpreted to mean the Contracting Officer. Devices and equipment for fire protection service shall be UL listed UL 04 or FM approved FM P7825.

1.2.3 Sequence of Operation

1.2.3.1 Pressure Maintenance Pump

Pressure maintenance pump shall operate when the system pressure drops to 10 psi less than stop point. Pump shall automatically stop when the system pressure reaches equals churn pressure plus 10 psi and after the pump has operated for the minimum pump run time specified herein.

1.2.3.2 Primary Fire Pump

Primary fire pump shall automatically operate when the pressure drops to 5 psi less than jockey pump strat point. The fire pump shall automatically stop operating when the system pressure reaches Churn pressure plus water tank static head, and after the fire pump has operated for the minimum pump run time specified herein.

1.2.4 Safety Requirements

Coupling, rotating parts, gears, projecting equipment, etc. shall be fully enclosed or properly guarded so as to prevent possible injury to persons that come in close proximity of the equipment. The Contractor shall conduct testing of the fire pumps in a safe manner and ensure that all equipment is safely secured. Hoses and nozzles used to conduct flow tests shall be in excellent condition and shall be safely anchored and secured to prevent any misdirection of the hose streams.

1.2.5 Verification of Dimensions

The Contractor shall become familiar with all details of the work and verify all dimensions in the field. The Contractor shall notify the Contracting Officer of any discrepancy before performing the work.

1.2.6 Electrical Work

Electric motor and controls shall be in accordance with NFPA 20 and NFPA 70, unless more stringent requirements are specified herein or are indicated on the drawings. Electrical wiring and associated equipment shall be provided in accordance with NFPA 20 and Section 16415 ELECTRICAL WORK, INTERIOR.

1.2.7 Factory Tests

Fire pump shall be tested by the manufacturer before shipment to provide detailed performance data and to demonstrate its compliance with the specifications.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. Unless otherwise indicated, 6 copies of each item shall be submitted. Submittals, except Fire Protection Engineer's Qualifications shall be submitted concurrently as a complete package. Each submittal shall be certified in writing by the Fire Protection Engineer. The Fire Protection Engineer shall certify that the submittal is complete, that the equipment and equipment arrangement meets contract requirements, and that the proposed system is coordinated and compatible with all other equipment connected to the system, the physical space, and the power sources. The Fire Protection Engineer shall sign and date all shop drawing submittal sheets and revisions. The submittal will be reviewed by the U.S. Army Engineer District Fire Protection Engineer.

The following shall be submitted in accordance with Section 01300SUBMITTAL DESCRIPTIONS.

SD-01 Data

Equipment; GA.

Manufacturer's catalog data for each separate piece of equipment proposed for use in the system. Catalog data shall indicate the name of the manufacturer of each item of equipment, with data annotated to indicate model to be provided. In addition, a complete equipment list which includes equipment description, model number and quantity shall be provided. Catalog data for material and equipment shall include, but not be limited to, the following:

a. Fire pumps, drivers and controllers including manufacturer's certified shop test characteristic curve for each pump. Shop test curve may be submitted after approval of catalog data but shall be submitted prior to the final tests.

b. Pressure maintenance pump and controller.

c. Piping and fittings.

d. Valves, including gate, check, globe and relief valves.

e. Gauges.

f. Hose valve manifold test header and hose valves.

g. Flow meter.

h. Restrictive orifice union.

i. Associated devices and equipment.

Final Test; GA.

A written request for scheduling of the final test at least 15 days prior to the date that the final acceptance test is to take place and after successful completion of the preliminary tests.

SD-04 Drawings

Pump Room, Equipment and Piping; GA.

Detailed drawings consisting of a detailed plan view, detailed elevations and sections of the pump room, equipment and piping, drawn to a scale of not less than 1/2 inch = 1 foot. Drawings shall indicate equipment, piping, and associated pump equipment to scale. All clearance, such as those between piping and equipment; between equipment and walls, ceiling and floors; and for electrical working distance clearance around all electrical equipment shall be indicated. Drawings shall include a legend identifying all symbols, nomenclatures, and abbreviations. Drawings shall indicate a complete piping and equipment layout including elevations and/or section views of the following:

- a. Fire pumps, controllers, piping, valves, and associated equipment.
- b. Sensing line for each pump including the jockey pump.
- c. Engine fuel system for diesel driven pumps.
- d. Engine cooling system for diesel driven pumps.
- e. Pipe hangers and sway bracing including support for diesel muffler and exhaust piping.
- f. Restraint of underground water main at entry-and exit-points to the building.

A one-line schematic diagram indicating layout and sizes of all piping, devices, valves and fittings.

A complete point-to-point connection drawing of the pump power, control and alarm systems, as well as interior wiring schematics of each controller.

As-Built Drawings; GA.

Detailed drawings updated to reflect as-built conditions after all associated work is completed, on reproducible full-size mylar film, no later than 10 working days after completion of the Final Tests. Each as-built drawing shall have a title block similar to the contract drawings.

SD-06 Instructions

Framed Instructions; GA.

Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for safe operation, sequence of operation, and procedures for safely starting and stopping the system, prepared in typed form, framed under glass or in laminated plastic.

Instructions shall be posted where directed by the Contracting Officer. Wiring and control diagrams showing the complete layout of the entire system shall be framed under glass or in approved laminated plastic and posted near each controller as directed by the Contracting Officer. Proposed instructions, diagrams and other sheets shall be submitted for approval prior to posting. Framed instructions shall be posted before acceptance testing of the system.

SD-13 Certificates

Engineer's Qualifications; GA.

Prior to all other submittals, certification that the Fire Protection Engineer is a registered Fire Protection Engineer or a Registered Engineer who has had at least 4 years experience in fire protection and fire pump installation design.

Preliminary Test; GA.

A signed and dated certificate that preliminary tests have been conducted, and that the fire pump installation is complete and ready to be placed in operation, prior to submitting a formal request for a final inspection and test. The certificate shall include the names, companies, phone numbers, and titles of persons conducting and witnessing the test, including the required manufacturer's representatives. Complete test procedures, as well as results and readings taken during the preliminary tests shall be included.

Piping; FIO.

A signed statement from the piping manufacturer certifying that the piping meets requirements specified. The statement shall be signed and dated after the award of this contract, shall include the name of the project, and shall list the specific requirements which are being certified.

SD-18 Records

Test Procedures; GA.

Detailed test procedures for testing the fire pump system, 60 days prior to performing the pump tests.

SD-19 Operation and Maintenance Manuals

Fire Pumps; GA

Operating instructions outlining step-by-step procedures required for fire pump startup, operation and shutdown shall be provided. The instructions shall include the manufacturer's name, model number, catalog cuts, diagrams, drawings, parts list, and descriptive data covering the proper operation and testing. Six complete copies of maintenance instructions listing routine maintenance procedures and frequencies, possible breakdowns and repairs, troubleshooting guides, a complete list of parts and current sources, and recommended spare parts to be kept on hand. The instructions shall include simplified diagrams for the system as installed.

1.4 MANUFACTURER'S SERVICES

The Contractor shall obtain the services of the fire pump manufacturer, the fire pump controller manufacturer, and the diesel engine driver manufacturer (when provided) or their representative. The persons providing this service shall be factory-trained, shall be experienced in the installation, adjustment, and operation of the equipment and shall supervise the installation, the adjustments, and the testing of equipment. The persons providing the manufacturer service shall be present during the preliminary and final tests and shall assist in the testing of the equipment.

1.5 DELIVERY AND STORAGE

Equipment delivered to the site or placed in storage shall be protected from weather, humidity and temperature variations, dirt, dust, and other contaminants.

PART 2 PRODUCTS

2.1 FIRE PUMP

Fire pump shall be electric motor driven. Each pump capacity shall be rated at 64 liters per second (1000gpm) with a rated net pressure of 1379 psi. Fire pump shall furnish not less than 150 percent of rated flow capacity at not less than 65 percent of rated net pressure. Pump shall be centrifugal horizontal split case fire pump. Horizontal pump shall be equipped with automatic air release devices. The maximum rated pump speed shall be 2100 rpm when driving the pump at rated capacity. Pump shall conform to the requirements of UL 448. Fire pump discharge and suction gauges shall be oil-filled type.

2.2 ELECTRIC MOTOR DRIVER

Motor shall comply to NEMA MG 1 and be marked as complying with NEMA Design B standards. Motor horsepower shall be of sufficient size so that the nameplate horsepower rating will not be exceeded throughout the entire published pump characteristic curve. The motor and fire pump controller shall be fully compatible.

2.3 FIRE PUMP CONTROLLER

NEMA Type 2 drip-proof enclosure arranged so that controller current carrying parts will not be less than 12 inches above the floor. Controller shall be provided with voltage surge arresters installed per NFPA 20. Controller shall be equipped with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments, automatic starting relay actuated from normally closed contacts, visual alarm lamps and supervisory power light. Controller shall be equipped with a thermostat switch with adjustable setting to monitor the pump room temperature and to provide an alarm when temperatures falls below 40 degrees F.

2.3.1 Controller for Electric Motor Driven Fire Pump

Controller shall monitor pump running, loss of a phase or line power, phase reversal. Alarms shall be individually displayed in front of panel by lighting of visual lamps. Each lamp shall be labeled with rigid etched

plastic labels. Controller shall be equipped with terminals for remote monitoring of pump running, pump power supply trouble (loss of power or phase and phase reversal). Limited services fire pump controllers are not permitted, except for fire pumps driven by electric motors rated less than 11 kw (15 hp). Controller shall be equipped with a 7-day electric pressure recorder with 24-hour spring wound back-up. The pressure recorder shall provide a readout of the system pressure from 0 to 300 psi, time, and date. Controller shall require the pumps to run for ten minutes for pumps with driver motors under 200 horsepower and for 15 minutes for pumps with motors 200 horsepower and greater, prior to automatic shutdown. The controller shall be equipped with an externally operable isolating switch which manually operates the motor circuit. Means shall be provided in the controller for measuring current for all motor circuit conductors. Controller shall be across the line. Controller shall be designed as indicated. Controller shall have a short circuit rating as indicated.

2.4 PRESSURE SENSING LINE

A completely separate pressure sensing line shall be provided for each fire pump and for the jockey pump. The sensing line shall be arranged in accordance with Figure A-7-5.2.1. of NFPA 20. The sensing line shall be 1/2-inch H58 brass tubing complying with ASTM B 135. The sensing line shall be equipped with two restrictive orifice unions each. Restricted orifice unions shall be ground-face unions with brass restricted diaphragms drilled for a 3/32-inch orifice. Restricted orifice unions shall be mounted in the horizontal position, not less than 5 feet apart on the sensing line. Two test connections shall be provided for each sensing line. Test connections shall consist of two brass 1/2-inch globe valves and 1/4-inch gauge connection tee arranged per NFPA 20. One of the test connections shall be equipped with a 0-200 psi water oil-filled gauge. Sensing line shall be connected to the pump discharge piping between the discharge piping control valve and the check valve.

2.5 PRESSURE MAINTENANCE (JOCKEY) PUMP

Pressure maintenance pump shall be electric motor driven, in-line vertical shaft, centrifugal type with a rated discharge of 250 psi. Pump shall draft from the suction supply side of the suction pipe gate valve of the fire pump and shall discharge into the system at the downstream side of the pump discharge gate valve. An approved indicating gate valve of the outside screw and yoke (O.S.&Y.) type shall be provided in the maintenance pump discharge and suction piping. Oil-filled water pressure gauge and approved check valve in the maintenance pump discharge piping shall be provided. Check valve shall be swing type with removable inspection plate.

2.5.1 Pressure Maintenance Pump Controller

Pressure maintenance pump controller shall be arranged for automatic and manual starting and stopping and equipped with a "manual-off-automatic" switch. The controller shall be completely terminally wired, ready for field connections, and wall-mounted in a NEMA Type 2 drip-proof enclosure. The controller shall be equipped with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments for automatic starting and stopping. A sensing line shall be provided connected to the pressure maintenance pump discharge piping between the control valve and the check valve. The sensing line shall conform to paragraph, PRESSURE SENSING LINE. The sensing line shall be completely

separate from the fire pump sensing lines. An adjustable run timer shall be provided to prevent frequent starting and stopping of the pump motor. The run timer shall be set.

A common base plate shall be provided for each horizontal-shaft fire pump for mounting pump and driver unit. The base plate shall be constructed of cast iron with raised lip tapped for drainage or welded steel shapes with suitable drainage. Each base plate for the horizontal fire pumps shall be provided with a 1-inch galvanized steel drain line piped to the nearest floor drain. For vertical shaft pumps, pump head shall be provided with a cast-iron base plate and shall serve as the sole plate for mounting the discharge head assembly. Pump units and bases shall be mounted on a raised 6-inch reinforced concrete pad that is an integral part of the reinforced concrete floor.

2.6 ABOVEGROUND WATER PIPING

2.6.1 Pipe Sizes 2.5 Inches and Larger

2.6.1.1 Pipe

Piping shall be ASTM A 795, Weight Class STD (Standard), Schedule 40 (except for Schedule 30 for pipe sizes 8 inches and greater in diameter), Type E or Type S, Grade A; black steel pipe. Steel pipe shall be joined by means of flanges welded to the pipe or mechanical grooved joints only. Piping shall not be jointed by welding or weld fittings. Suction piping shall be galvanized on the inside per NFPA 20.

2.6.1.2 Flanges

Flanges shall be ASME B16.5, Class 150 flanges. Flanges shall be provided at valves, connections to equipment, and where indicated.

2.6.1.3 Gaskets

Gaskets shall be AWWA C111, cloth inserted red rubber gaskets.

2.6.1.4 Bolts

Bolts shall be ASTM A 193, Grade B8. Bolts shall extend no less than three full threads beyond the nut with bolts tightened to the required torque.

2.6.1.5 Nuts

Nuts shall be ASTM A 194, Grade 8.

2.6.1.6 Washers

Washers shall meet the requirements of ASTM F 436. Flat circular washers shall be provide under all bolt heads and nuts.

2.6.2 Piping Sizes 2 Inches and Smaller

2.6.2.1 Steel Pipe

Steel piping shall be ASTM A 795, Weight Class STD (Standard), Schedule 40,

Type E or Type S, Grade A, zinc-coated steel pipe with threaded end connections. Fittings shall be ASME B16.39, Class 150, zinc-coated threaded fittings. Unions shall be ASME B16.39, Class 150, zinc-coated unions.

2.6.2.2 Copper Tubing

Copper tubing shall be ASTM B 88, Type L or K, soft annealed. Fittings shall be ASME B16.26, flared joint fittings. Pipe nipples shall be ASTM B 42 copper pipe with threaded end connections.

2.6.3 Pipe Hangers and Supports

Pipe hangers and support shall be UL listed UL 04 or FM approved FM P7825 and shall be the adjustable type. Finish of rods, nuts, washers, hangers, and supports shall be zinc-plated after fabrication.

2.6.4 Valves

Valves shall be UL listed UL 04 or FM approved FM P7825 for fire protection service. Valves shall have flange or threaded end connections.

2.6.4.1 Gate Valves and Control Valves

Gate valves and control valves shall be outside screw and yoke (O.S.&Y.) type which open by counterclockwise rotation. Butterfly-type control valves are not permitted.

2.6.4.2 Circulating Relief Valve

An adjustable circulating relief valve shall be provided for each fire pump in accordance with NFPA 20.

2.6.4.3 Suction Pressure Regulating Valve

Suction pressure regulating valve shall be FM approved FM P7825. Suction pressure shall be monitored through a pressure line to the controlling mechanism of the regulating valve. Valve shall be arranged in accordance with the manufacturer's recommendations.

2.7 HOSE VALVE MANIFOLD TEST HEADER

Hose valve test header shall be connected by ASME B16.5, Class 150 flange inlet connection. Hose valves shall be UL listed UL 04 or FM approved FM P7825 bronze hose gate valves with 2.5-inch American National Fire Hose Connection Screw Standard Threads (NH) per NFPA 1963. The number of valves shall be per NFPA 20. Each hose valve shall be equipped with a cap and chain, and located no more than 3 feet and no less than 2 feet above grade.

2.8 PIPE SLEEVE

A pipe sleeve shall be provided at each location where piping passes through walls, ceilings, roofs, and floors, including pipe entering buildings from the exterior. Sleeves shall be grouted in position during construction. Sleeve shall be of sufficient length to pass through the entire thickness of the wall, ceilings, roofs and floors. Not less than 1

inch clearance shall be provided between pipe exterior surface and the interior of the sleeve, and between the tie rods and the interior of the sleeve. The space shall be firmly packed with mineral wool insulation and caulk at both ends with plastic waterproof cement which will dry to a firm but pliable mass, or with a segmented elastomeric seal. Where pipes pass through fire walls or fire floors, a fire seal shall be provided between the pipe and the sleeve in accordance with Section 07270 FIRESTOPPING. Sleeves in masonry and concrete walls, ceiling, roofs and floors shall be hot-dip galvanized steel, ductile-iron, or cast-iron. Other sleeves shall be galvanized steel sheet pipe not less than 0.90 psf.

2.9 ESCUTCHEON (WALL) PLATES

Escutcheon plates shall be one-piece or split-hinge type metal plates and shall be provided for piping passing through floors, walls, and ceiling in exposed areas. In finished areas, plates shall be polished stainless steel or chromium-plated finish on copper alloy. In unfinished areas, plates shall have painted finish. Plates shall be secured in position.

2.10 UNDERGROUND PIPING

2.10.1 Pipe and Fittings

Underground piping and piping under the building slab shall be ductile-iron pipe and fittings. Piping shall be AWWA C151 ductile-iron pipe with AWWA C110 fittings and shall conform to NFPA 24. Piping beyond 5 feet of the building shall be provided under Section 02660 WATER LINES.

2.10.2 Valves

Valves shall be gate valves conforming to AWWA C500 or UL 262. Valves shall have cast-iron body and bronze trim. Valve shall open by counterclockwise rotation.

2.10.2.1 Valve Boxes

Except for post indicator valves, all underground valves shall be provided with an adjustable cast-iron or ductile iron valve box of a size suitable for the valve on which the box is to be used, but not less than 5.25 inches in diameter. The box shall be coated with bituminous coating. A cast-iron or ductile-iron cover with the word "WATER" cast on the cover shall be provided for each box.

2.10.2.2 POST INDICATOR VALVES (PIVS)

Valves shall conform to UL 262. Indicator post shall conform to UL 789. PIVs shall have operating nut and removable operating handle. PIVs shall be lockable with standard padlock. PIVs shall be painted with one coat of primer and two coats of red enamel paint.

2.10.3 Buried Utility Warning and Identification Tape

Detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping shall be provided for all buried piping. Tape shall be detectable by an electronic detection instrument. Tape shall be color-coded for the utility involved and imprinted in bold black letters continuously and

repeatedly over the entire tape length. Warning and identification shall be "CAUTION BURIED WATER PIPING BELOW" or similar wording. Code and lettering shall be permanent and unaffected by moisture and other substances contained in the trench backfill material. Tape shall be buried at a depth of 12 inches below the top surface of earth or the top surface of the subgrade under pavement.

2.11 CHLORINATING AGENTS

Chlorinating agent must comply to one of the following.

2.11.1 Liquid Chlorine

AWWA B301

2.11.2 Calcium Hypochlorite and Sodium Hypochlorite

AWWA B300

PART 3 EXECUTION

3.1 INSTALLATION

Installation, workmanship, fabrication, assembly, erection, examination, inspection and testing shall be in accordance NFPA 20, except as modified herein. In addition, the fire pump and engine shall be installed in accordance with the written instructions of the manufacturer.

3.2 PIPE AND FITTINGS

Piping shall be inspected, tested and approved before burying, covering, or concealing. Fittings shall be provided for changes in direction of piping and for all connections. Changes in piping sizes shall be made using tapered reducing pipe fittings. Bushings shall not be used.

3.2.1 Cleaning of Piping

Interior and ends of piping shall be clean and free of any water or foreign material. Piping shall be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of the piping shall be securely closed so that no water or foreign matter will enter the pipes or fittings. Piping shall be inspected before placing in position.

3.2.2 Threaded Connections

Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape conforming to MS MIL-T-27730 and shall be applied to male threads only. Exposed ferrous pipe threads shall be provided with one coat of zinc molybdate primer applied to a minimum of dry film thickness of 1 mil.

3.2.3 Pipe Hangers and Supports

Additional hangers and supports shall be provided for concentrated loads in aboveground piping, such as for valves and risers.

3.2.3.1 Vertical Piping

Piping shall be supported at each floor, but not more than 10-foot intervals.

3.2.3.2 Horizontal Piping

Horizontal piping supports shall be spaced as follows:

MAXIMUM SPACING (FEET)										
Nominal Pipe Size (inches)	1 and Under	1.25	1.5	2	2.5	3	3.5	4	5	
Copper Tube	6	7	8							
Steel Pipe	7	8	9	10	11	12	13	14	16	17

3.2.4 Underground Piping

Installation of underground piping and fittings shall conform to NFPA 24. Joints shall be anchored in accordance with NFPA 24. Concrete thrust block shall be provided at elbow where pipe turns up towards floor, and the pipe riser shall be restrained with steel rods from the elbow to the flange above the floor. After installation per NFPA 24, rods and nuts shall be thoroughly cleaned and coated with asphalt or other corrosion-retard material approved by the Contracting Officer. Minimum depth of cover shall be 3 feet.

3.3 ELECTRICAL WORK

Except as modified herein, interior wiring methods shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR; exterior wiring methods shall be in accordance with Section 16735 ELECTRICAL DISTRIBUTION SYSTEMS, UNDERGROUND or Section 16730 ELECTRICAL DISTRIBUTION SYSTEMS, AERIAL as appropriate.

3.4 FIELD PAINTING AND FINISHING

Field painting and finishing shall conform to the requirements specified in Section 09900 PAINTING, GENERAL. Pipe shall be painted with 2 coats of red enamel paint conforming to FS TT-E-489, Class A. Factory primed surfaces shall be solvent-cleaned before painting. Surfaces that have not been factory primed shall be prepared and primed in accordance with the recommendations of the enamel paint manufacturer. Piping shall be provided with plastic labels of standard manufacture to identify piping as FIRE PUMP DISCHARGE, FIRE PUMP SUCTION, FIRE PUMP BYPASS, FIRE PUMP TEST HEADER, TO SYSTEM, and RELIEF VALVE DISCHARGE. Labels shall have red letters 1-inch

high, 1/4-inch brush stroke, on white background.

3.5 INSTRUCTING OPERATING PERSONNEL

Upon completion of the work and at a time designated by the Contracting Officer, the Contractor shall provide, for a period of not less than one 8-hour working day, the services of experienced technicians regularly employed by the manufacturer of the fire pump, the fire pump controller, and the pump drivers to instruct Government operating personnel in the proper operation, inspection, testing, and maintenance of the equipment. Manufacturer's representatives who were present during the final tests shall be present and shall conduct or assist in the instruction.

3.6 FLUSHING

The fire pump suction and discharge piping shall be flushed at 120 percent of rated capacity of each pump. Where the pump installation consists of more than one pump, the flushing shall be the total quantity of water flowing when all pumps are discharging at 120 percent of their rated capacities. The new pumps may be used to attain the required flushing volume. Flushing operations shall continue until water is clear, but not less than 10 minutes. The Contractor shall submit a signed and dated flushing certificate before requesting field testing.

3.7 FIELD TESTS

3.7.1 Hydrostatic Test

Piping shall be hydrostatically tested at 225 psig for a period of 2-hours, or at least 50 psi in excess of the maximum pressure, when the maximum pressure in the system is in excess of 175 psi.

3.7.2 Preliminary Test

The fire pump manufacturer, the fire pump controller manufacturer, and the diesel engine manufacturer (when supplied) or their representative shall witness the complete operational testing of the fire pump and drivers. Fire pumps, drivers and equipment shall be thoroughly inspected and tested to insure that the system is correct, complete, and ready for operation. Tests shall ensure that pumps are operating at rated capacity, pressure and speed. Tests shall include manual starting and running to ensure proper operation and to detect leakage or other abnormal conditions, flow testing, automatic start testing, testing of automatic settings, sequence of operation check, test of required accessories; test of pump alarms devices and supervisory signals, test of pump cooling, operational test of relief valves, and test of automatic power transfer, if provided. Pumps shall run without abnormal noise, vibration or heating. If any component or system was found to be defective, inoperative, or not in compliance with the contract requirements during the tests and inspection, the corrections shall be made and the entire preliminary test shall be repeated. All test results and readings shall be recorded during the tests and signed by the witnessing manufacturer's representative.

3.7.3 Final Test

The Engineer District Fire Protection Engineer will witness the final

tests. The Contractor shall take all readings and measurements. An experienced technician regularly employed by the pump installer shall be present during the test. The pump manufacturer, the fire pump controller manufacturer, and the diesel engine manufacturer (when supplied), or their representative shall be present for the final tests. Where pumps are diesel driven, an experienced technician employed by the engine manufacturer capable of demonstrating engine trouble alarms and operating features shall be present. The Contractor shall be responsible for repairing any damage caused by hose streams or other aspects of the test. The final acceptance test shall include the following:

3.7.3.1 Inspection

Thorough inspection of the fire pump installation, including visual observation of the pump while running shall be conducted. There shall be no excessive vibration, leaks (oil or water), unusual noises, overheating, or other potential problems. Inspection shall include piping and equipment clearance, access, supports, and guards.

3.7.3.2 Flow Tests

Flow tests using the test header, hoses and playpipe nozzles shall be conducted. Flow tests shall be performed at churn (no flow), 75, 100, 125 and 150 percent capacity for each pump and at full capacity of the pump installation. Flow readings shall be taken from each nozzle by means of a calibrated pitot tube with gauge or other approved measuring equipment. Rpm, suction pressure and discharge pressure reading shall be taken as part of each flow test. Voltage and ampere readings shall taken on each phase as part of each flow test for electric-motor driven pumps.

3.7.3.3 Starting Tests

Pumps shall be tested for automatic starting and sequential starting. Setting of the pressure switches shall be tested when pumps are operated by pressure drop. Tests may be performed by operating the test connection on the pressure sensing lines. As a minimum, each pump shall be started automatically 10 times and manually 10 times, in accordance with NFPA 20. Tests of engine-driven pumps shall be divided equally between both set of batteries. The fire pumps shall be operated for a period of a least 10 minutes for each of the starts; except that electric motors over 200 horsepower shall be operated for at least 15 minutes and shall not be started more than 2 times in 10 hours.

3.7.3.4 Battery Changeover

Diesel driven fire pumps shall be tested for automatic battery changeover in event of failure of initial battery units.

3.7.3.5 Alarms

All pump alarms, both local and remote, shall be tested. Supervisory alarms for diesel drivers shall be electrically tested for low oil

pressure, high engine jacket coolant temperature, shutdown from overspeed, battery failure and battery charger failure.

3.7.3.6 Miscellaneous

Valve tamper switches shall be tested. Pressure recorder operation relief valve settings, valve operations, operation and accuracy of meters and gauges, and other accessory devices shall be verified.

3.7.3.7 Alternate Power Source

On installations with an alternate source of power and an automatic transfer switch, loss of primary power shall be simulated and transfer shall occur while the pump is operating at peak load. Transfer from normal to emergency source and retransfer from emergency to normal source shall not cause opening of overcurrent devices in either line. At least half of the manual and automatic starting operations listed shall be performed with the fire pump connected to the alternate source.

3.7.4 Correction of Deficiencies

If equipment was found to be defective or non-compliant with contract requirements, the Contractor shall performed corrective actions and repeat the tests. Tests shall be conducted and repeated if necessary until the system has been demonstrated to comply with all contract requirements.

3.7.5 Test Equipment

The Contractor shall provide all equipment and instruments necessary to conduct a complete final test, including 2.5-inch diameter hoses, playpipe nozzles, pitot tube gauges, portable digital tachometer, voltage and ampere meters, and calibrated oil-filled water pressure gauges. The Contractor shall provide all necessary supports to safely secure hoses and nozzles during the test. The Contractor shall furnish water for the tests.

3.7.6 Test Documentation

Contractor shall supply a copy of the manufacturer's certified curve for each fire pump at the time of the test. The Contractor shall record all test results and plot curve of each pump performance during the test. The Contractor shall provide complete pump acceptance test data of each fire pump. The pump acceptance test data shall be on forms that give the detail pump information such as that which is indicated in Figure A-11-2.6.3(f) of NFPA 20. The Contractor shall provide pump test data sheet in a properly labeled three ring binder.

3.8 DISINFECTION

Before acceptance of the fire pump installation, the complete system and existing water piping affected by the Contractor's operations shall be disinfected in accordance with AWWA C651as specified herein. After pressure tests have been made, the fire pump piping to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud have been

removed before introducing in chlorinating material. The chlorinating material shall be either liquid chlorine, calcium hypochlorite, or sodium hypochlorite, conforming to paragraph CHLORINATING AGENTS. The chlorinating material shall be provided to achieve a dosage of not less than 50 ppm and shall be introduced into the fire pump piping in an approved manner. The treated water shall be retained in the pipe long enough to destroy all non-spore-forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 10 ppm of chlorine throughout the system at the end of the retention time. All valves in the piping to be disinfected shall be opened and closed several times during the retention period. The line shall be flushed with clean water until the residual chlorine is reduced to 1.0 ppm. Samples of water in proper sterilized containers for bacteriological examination will be taken from several system locations which are approved by the Contracting Officer. Samples will be given to the Contracting Officer for accomplishing bacteriological examination of the water samples. The disinfection shall be repeated until tests indicate the absence of pollution for at least 2 full days. The unit will not be accepted until satisfactory bacteriological results have been obtained.

<END>-- End of Section --
</END>

SECTION 15330

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION
07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	(1990) Ferritic Malleable Iron Castings
ASTM A 53	(1995a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 135	(1993) Electric-Resistance-Welded Steel Pipe
ASTM A 183	(1983; R 1990) Carbon Steel Tract Bolts and Nuts
ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM A 795	(1995) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B 88	(1995a) Seamless Copper Water Tube
ASTM D 3309	(1994) Polybutylene (PB) Plastic Hot-and Cold-Water Distribution Systems
ASTM F 442	(1994) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1	(1989) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.4	(1992) Cast Iron Threaded Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1991) Forged Fittings, Socket-Welding and Threaded

ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1995) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B18.2.1	(1981; Supple 1991; R 1992) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(1987; R 1993) Square and Hex Nuts (Inch Series)

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1015	(1993) Double Check Backflow Prevention Assembly
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AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA-10062JU	(1992) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(1992) Hypochlorites
AWWA B301	(1992) Liquid Chlorine
AWWA C104	(1990) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(1990) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	(1991) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C203	(1991) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA M20	(1973) Manual: Water Chlorination Principles and Practices

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825	(1995; Supple I; Supple II; Supple III) Approval Guide
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MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-71 (1990) Cast Iron Swing Check Valves,
Flanges and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13 (1994) Installation of Sprinkler Systems

NFPA 13R (1994) Installation of Sprinkler Systems in
Residential Occupancies Up to and Including
Four Stories in Height

NFPA 24 (1995) Installation of Private Fire Service
Mains and Their Appurtenances

NFPA 231C (1995) Rack Storage of Materials

NFPA 1963 (1993) Fire Hose Connections

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES
(NICET)

NICET 1014 (1995) Program Detail Manual for
Certification in the Field of Fire
Protection Engineering Technology (Field
Code 003) Automatic Sprinkler System Layout

UNDERWRITERS LABORATORIES (UL)

UL-01 (1996) Building Materials Directory

UL-04 (1996; Supple) Fire Protection Equipment
Directory

UL 668 (1989; Rev Feb 1994) Hose Valves For Fire
Protection Service

1.2 GENERAL REQUIREMENTS

Wet pipe sprinkler system shall be provided in areas indicated on the drawings. The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13R. Rack sprinkler shall be in accordance with NFPA 231C. Pipe sizes which are not indicated on drawings shall be determined by hydraulic calculation.

1.2.1 Hydraulic Design

The system shall be hydraulically designed to discharge a minimum density of gpm per square foot over the hydraulically most demanding 3,000 square feet of floor area. The minimum pipe size for branch lines in gridded systems shall be 1-1/4 inch. Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13.

1.2.1.1 Hose Demand

An allowance for exterior hose streams of gpm shall be added to the sprinkler system demand at the fire hydrant shown on the drawings closest

to the point where the water service enters the building.

1.2.1.2 Basis for Calculations

The design of the system shall be based upon a water supply as defined in section 15332 Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, 140 for new cement-lined ductile-iron piping, and 100 for existing underground piping.

1.2.2 Sprinkler Spacing

Sprinklers shall be uniformly spaced on branch lines. Maximum spacing per sprinkler shall not exceed square feet. limits specified in NFPA 13 for ordinary hazard occupancy.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. Submittals related to system configuration, hydraulic calculations, and equipment selection, including manufacturer's catalog data, working drawings, connection drawings, control diagrams and certificates shall be submitted concurrently as a complete package. The package will be reviewed by the U.S. Army Engineer District Fire Protection Engineer. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Load Calculations for Sizing Sway Bracing

For systems that are required to be protected against damage from earthquakes, load calculations shall be provided for sizing of sway bracing.

Sprinkler System Equipment; GA.

Manufacturer's Catalog Data for each separate piece of equipment proposed for use in the system. Data shall indicate the name of the manufacturer of each item of equipment, with data highlighted to indicate model, size, options, etc. proposed for installation. In addition, a complete equipment list which includes equipment description, model number and quantity shall be provided.

Hydraulic Calculations; GA.

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

Spare Parts; GA

Spare parts data shall be included for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

SD-04 Drawings

Sprinkler System Shop Drawings; GA.

Detail drawings conforming to the requirements established for working plans as prescribed in NFPA 13. Drawings shall include plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

- a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.
- b. Floor plans drawn to a scale not less than $1/8" = 1'-0"$ which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.
- c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.
- d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.
- e. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring.

As-Built Drawings; GA.

As-built drawings, no later than 14 working days after completion of the Final Tests. The sprinkler system shop drawings shall be updated to reflect as-built conditions after work is completed and shall be on reproducible full-size mylar film.

SD-06 Instructions

Test Procedures; GA.

Proposed test procedures for piping hydrostatic test, testing of alarms, at least 14 days prior to the start of related testing.

SD-07 Schedules

Preliminary Tests; GA

A schedule of preliminary tests, at least 14 days prior to the proposed

start of the tests.

Final Test; GA

Upon successful completion of tests specified under PRELIMINARY TESTS, written notification shall be given to the Contracting Officer of the date for the final acceptance test. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

SD-08 Statements

Installer Qualifications; GA.

Qualifications of the sprinkler installer.

Submittal Preparer's Qualifications; GA.

The name and documentation of certification of the individual who will prepare the submittals, prior to the submittal of the drawings and hydraulic calculations.

SD-13 Certificates

Contractor's Material & Test Certificates; GA.

Certificates, as specified in NFPA 13, shall be completed and signed by the Contractor's Representative performing required tests for both underground and aboveground piping.

SD-19 Operation and Maintenance Manuals

Sprinkler System; GA.

Manuals shall be in loose-leaf binder format and grouped by technical sections consisting of manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. The manuals shall list routine maintenance procedures possible breakdowns, and repairs, and troubleshooting guide. This shall include procedures and instructions pertaining to frequency of preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

1.4 HYDRAULIC CALCULATIONS

Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software specifically designed for fire protection system design. Software which uses k-factors for typical branch lines is not acceptable. Calculations shall be taken back to the water supply source unless water supply data is otherwise indicated. Calculations shall substantiate that the design area indicated is the hydraulically most demanding. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall

be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

1.5 SUBMITTAL PREPARER'S QUALIFICATIONS

The sprinkler system submittals, including as-built drawings, shall be prepared by an individual who is either a registered professional engineer or who is certified as a Level III Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014.

1.6 INSTALLER QUALIFICATIONS

The installer shall be experienced and regularly engaged in the installation of the type and complexity of system included in this project. A statement prior to submittal of any other data or drawings, that the proposed sprinkler system installer is regularly engaged in the installation of the type and complexity of system included in this project shall be provided. In addition, data identifying the location of at least three systems recently installed by the proposed installer which are comparable to the system specified shall be submitted. Contractor shall certify that each system has performed satisfactorily, in the manner intended, for a period of not less than 6 months.

1.7 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. Applicable material and installation standards referenced in Appendix A of NFPA 13 and NFPA 24 shall be considered mandatory the same as if such referenced standards were specifically listed in this specification. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. All requirements that exceed the minimum requirements of NFPA 13 shall be incorporated into the design. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

1.8 DELIVERY AND STORAGE

Equipment placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust or other contaminants.

PART 2 PRODUCTS

2.1 GENERAL EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.1.2 Requirements for Fire Protection Service

Equipment and materials shall have been tested by Underwriters Laboratories, Inc. and listed in UL-04 or approved by Factory Mutual and listed in FM P7825. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL-04 or FM P7825.

2.1.3 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate permanently affixed to the item of equipment.

2.2 UNDERGROUND PIPING SYSTEMS

2.2.1 Pipe

Piping from a point 6 inches above the floor to a point 5 feet outside the building wall shall be ductile iron with a rated working pressure of 175 psi conforming to AWWA C151, with cement mortar lining conforming to AWWA C104. Piping more than 5 feet outside the building walls shall comply with Section 02660 WATER LINES.

2.2.2 Fittings and Gaskets

Fittings shall be ductile iron conforming to AWWA C110. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile iron pipe joints shall conform to AWWA C111.

2.2.3 Gate Valve and Indicator Posts

Gate valves for underground installation shall be of the inside screw type with counter-clockwise rotation to open. Where indicating type valves are shown or required, indicating valves shall be gate valves with an approved indicator post of a length to permit the top of the post to be located 3 feet above finished grade. Gate valves and indicator posts shall be listed in UL-04 or FM P7825.

2.3 ABOVEGROUND PIPING SYSTEMS

Aboveground piping shall be steel.

2.3.1 Steel Piping System

2.3.1.1 Steel Pipe

Except as modified herein, steel pipe shall be black as permitted by NFPA 13 and shall conform to applicable provisions of ASTM A 795, ASTM A 53, or ASTM A 135. Pipe in which threads or grooves are cut shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion

resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

2.3.1.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Steel press fittings shall be approved for fire protection systems. Galvanized fittings shall be used for piping systems or portions of piping systems utilizing galvanized piping.] Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings which use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.3.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 175 psi service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.3.1.4 Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1/16 inch thick, and full face or self-centering flat ring type. Bolts shall be squarehead conforming to ASME B18.2.1 and nuts shall be hexagon type conforming to ASME B18.2.2.

2.3.2 Pipe Hangers

Hangers shall be listed in UL-04 or FM P7825 and of the type suitable for the application, construction, and pipe type and sized involved.

2.3.3 Valves

2.3.3.1 Control Valve and Gate Valve

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type and shall be listed in UL-01 or FM P7825.

2.3.3.2 Check Valve

Check valve 2 inches and larger shall be listed in UL-01 or FM P7825. Check valves 4 inches and larger shall be of the swing type with flanged cast iron body and flanged inspection plates, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

2.4 ALARM INITIATING AND SUPERVISORY DEVICES

2.4.1 Sprinkler Waterflow Indicator Switch, Vane Type

Switch shall be vane type with a pipe saddle and cast aluminum housing. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe. The device shall sense water movements and be capable of detecting a sustained flow of 10 gpm or greater. The device shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall include two SPDT (Form C) contacts, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

2.4.2 Sprinkler Pressure (Waterflow) Alarm Switch

Pressure switch shall include a metal housing with a neoprene diaphragm, SPDT snap action switches and a 1/2 inch NPT male pipe thread. The switch shall have a maximum service pressure rating of 175 psi. There shall be two SPDT (Form C) contacts factory adjusted to operate at 4 to 8 psi. The switch shall be capable of being mounted in any position in the alarm line trim piping of the alarm check valve.

2.5 SPRINKLERS

Sprinklers shall be used in accordance with their listed spacing limitations. Temperature classification shall be ordinary. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13.

2.5.1 Upright Sprinkler

Upright sprinkler shall be brass and shall have a nominal 1/2 inch or 17/32 inch orifice.

2.6 DISINFECTING MATERIALS

2.6.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

2.6.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

2.7 ACCESSORIES

2.7.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

2.7.2 Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 3/4 inch and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

2.7.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

2.7.4 Sprinkler Guard

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers located as indicated.

2.7.5 Identification Sign

Valve identification sign shall be minimum 6 inches wide x 2 inches high with enamel baked finish on minimum 18 gauge steel or 0.024 inch aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

PART 3 EXECUTION

3.1 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein. Installation of in-rack sprinklers shall comply with applicable provisions of NFPA 231C.

3.2 ABOVEGROUND PIPING INSTALLATION

Piping shall be run straight and bear evenly on hangers and supports.

3.2.1 Protection of Piping Against Earthquake Damage

The system piping shall be protected against damage from earthquakes. Seismic protection of the piping system shall be provided in accordance with NFPA 13 and Appendix A, with the exception that the "Earthquake Zones" map of Appendix A shall not apply to this project. Seismic protection shall include flexible couplings, sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required in NFPA 13 for protection of piping against damage from earthquakes. Branch lines shall be equipped with sway braces at the end sprinkler head and at intervals not exceeding 30 ft. Protection of piping from earthquake damage is not required.

3.2.2 Piping in Exposed Areas

Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

3.2.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and

similar vertical runs of piping in finished areas shall be concealed.

3.2.4 Pendent Sprinklers

Drop nipples to pendent sprinklers shall consist of minimum 1 inch pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 12 inches. Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling shall not extend more than 1 inch below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 4 inches. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area.

3.2.4.1 Pendent Sprinkler Locations

Pendent sprinklers in suspended ceilings shall be a minimum of 6 inches from ceiling grid.

3.2.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 30 inches in length shall be individually supported.

3.2.6 Pipe Joints

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings and fittings shall be from the same manufacturer.

3.2.7 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2 inch.

3.2.8 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger

fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes pass through fire walls, fire partitions, or floors, a fire seal shall be placed between the pipe and sleeve in accordance with Section 07270 FIRESTOPPING. In penetrations which are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement which will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.2.9 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

3.2.10 Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 1 inch pipe connected to the remote branch line; a test valve located approximately 7 feet above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test." The discharge orifice shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping during full flow discharge.

3.2.11 Drains

Main drain piping shall be provided to discharge at a safe point outside the building at the location indicated. Auxiliary drains shall be provided as required by NFPA 13 except that drain valves shall be used where drain plugs are otherwise permitted. Where branch lines terminate at low points and form trapped sections, such branch lines shall be manifolded to a common drain line.

3.2.12 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.3 UNDERGROUND PIPING INSTALLATION

The fire protection water main shall be laid, and joints anchored, in accordance with NFPA 24. Minimum depth of cover shall be 36 inches. The supply line shall terminate inside the building with a flanged piece, the bottom of which shall be set not less than 6 inches above the finished floor. A blind flange shall be installed temporarily on top of the flanged piece to prevent the entrance of foreign matter into the supply line. A concrete thrust block shall be provided at the elbow where

the pipe turns up toward the floor. In addition, joints shall be anchored in accordance with NFPA 24 using pipe clamps and steel rods from the elbow to the flange above the floor and from the elbow to a pipe clamp in the horizontal run of pipe. Buried steel components shall be provided with a corrosion protective coating in accordance with AWWA C203. Piping more than 5 feet outside the building walls shall meet the requirements of Section 02660 WATER LINES.

3.4 EARTHWORK

Earthwork shall be performed in accordance with applicable provisions of Section 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

3.5 ELECTRICAL WORK

Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section 16721 FIRE DETECTION AND ALARM SYSTEM. Wiring color code shall remain uniform throughout the system.

3.6 STERILIZATION

After system components have been installed and pressure tested, each portion of the completed system shall be sterilized. After pressure tests have been made, the portion to be sterilized shall be thoroughly flushed with water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump, shall be used. Chlorination application shall continue until the entire system is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall be then flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in properly sterilized containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA-10062JU. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The sterilization shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.7 FIELD PAINTING AND FINISHING

Field painting and finishing are specified in Section 09900 PAINTING, GENERAL.

3.8 PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground

piping and system components, shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTALS.

3.8.1 Underground Piping

3.8.1.1 Flushing

Underground piping shall be flushed in accordance with NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less than the calculated maximum water demand rate of the system.

3.8.1.2 Hydrostatic Testing

New underground piping shall be hydrostatically tested in accordance with NFPA 24. The allowable leakage shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage at the joints shall not exceed 2 quarts per hour per 100 gaskets or joints, regardless of pipe diameter.

3.8.2 Aboveground Piping

3.8.2.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 200 psi or 50 psi in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

3.8.3 Testing of Alarm Devices

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm device shall be tested to verify proper operation.

3.8.4 Main Drain Flow Test

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.9 FINAL ACCEPTANCE TEST

A technician employed by the installing Contractor shall be present for the final tests and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the

main drain test shall be repeated to assure that control valves are in the open position. In addition, the representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received.

-- End of Section --

SECTION 15400

PLUMBING, GENERAL PURPOSE
07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications of the latest edition listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 700	(1995) Specifications for Fluorocarbon and Other Refrigerants
ARI 1010	(1994) Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.10.1	(1993; Z21.10.1a; Z21.10.1b; Z21.10.1c) Gas Water Heaters Vol. I Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less
ANSI Z21.10.3	(1993; Z21.10.3a; Z21.10.3b) Gas Water Heaters Vol. III Storage, With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous Water Heaters Reinforcement
ANSI Z21.22	(1986; Z21.22a) Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems
ANSI Z21.56	(1994; Z21.56a) Gas-Fired Pool Heaters
ANSI Z124.1	(1995) Plastic Bathtub Units
ANSI Z124.3	(1995) Plastic Lavatories

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	(1990) Ferritic Malleable Iron Castings
ASTM A 74	(1996) Cast Iron Soil Pipe and Fittings
ASTM A 105	(1996) Forgings, Carbon Steel, for Piping Components
ASTM A 183	(1994; Z21.56a) Gas-Fired Pool Heaters
ASTM A 193	(1996) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature

	Service
ASTM A 515	(1992) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A 516	(1990) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A 518	(1992) Corrosion-Resistant High-Silicon Iron Castings
ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM A 733	(1993) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A 888	(1994) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B 32	(1995b) Solder Metal
ASTM B 42	(1993) Seamless Copper Pipe, Standard Sizes
ASTM B 43	(1994) Seamless Red Brass Pipe, Standard Sizes
ASTM B 75	(1993) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B 88	(1996) Seamless Copper Water Tube
ASTM B 111	(1993) Copper and Copper-Alloy Seamless Condenser Tubes and Ferule Stock
ASTM B 117	(1994) Operating Salt Spray (Fog) Testing Apparatus
ASTM B 152	(1994) Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B 306	(1996) Copper Drainage Tube (DWV)
ASTM B 370	(1992) Copper Sheet and Strip for Building Construction
ASTM B 584	(1996) Copper Alloy Sand Castings for General Applications
ASTM B 641	(1993) Seamless and Welded Copper Distribution Tube (Type D)
ASTM B 813	(1993) Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
ASTM B 828	(1992) Making Capillary Joints by Soldering of Copper and Copper-Alloy Tube and Fittings
ASTM C 564	(1995) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 920	(1994) Elastomeric Joint Sealants
ASTM C 1053	(1990) Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications
ASTM D 638	(1996) Tensile Properties of Plastics
ASTM D 1004	(1994a) Initial Tear Resistance of Plastic Film and Sheet
ASTM D 1248	(1984; R 1989) Polyethylene Plastics Molding and Extrusion Materials
ASTM D 1785	(1994) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2000	(1996) Rubber Products in Automotive Applications

ASTM D 2235	(1993a) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D 2239	(1994) Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
ASTM D 2241	(1994) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2447	(1993) Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
ASTM D 2464	(1994) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1994a) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	1994) Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2485	(1991; R 1996) Evaluating Coatings for High Temperature Service
ASTM D 2564	(1993) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2661	(1995) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2665	(1995) Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2672	(1993; R 1995) Joints for IPS PVC Pipe Using Solvent Cement
ASTM D 2683	(1993) Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D 2737	(1993) Polyethylene (PE) Plastic Tubing
ASTM D 2822	(1991) Asphalt Roof Cement
ASTM D 2846	(1995a) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM D 2855	(1993) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 2996	(1995) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 3035	(1993) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D 3122	(1993) Solvent Cements for Styrene-Rubber (SR) Plastic Pipe and Fittings
ASTM D 3138	(1993) Solvent Cements for Transition Joints Between Acrylonitrile Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components
ASTM D 3139	(1989; R 1995) Joints for Plastic Pressure Pipes Using Flexible Elastomeric

	Seals
ASTM D 3212	(1992) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3261	(1993) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D 3308	(1991a) PTFE Resin Skived Tape
ASTM D 3311	(1994) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
ASTM D 4060	(1995) Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM D 4101	(1995a) Propylene Plastic Injection and Extrusion Materials
ASTM D 4551	(1991) Poly(Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane
ASTM E 1	(1995) ASTM Thermometers
ASTM E 96	(1995) Water Vapor Transmission of Materials
ASTM F 409	(1995) Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings
ASTM F 437	(1993) Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM D 438	(1993) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F 439	(1993a) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 441	(1995) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40and 80
ASTM F 442	(1994) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
ASTM F 477	(1995) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 493	(1993a) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
ASTM F 628	(1995)Acrylonitrile-Butadiene-Styrene (ABS)Schedule 40 Plastic Drain, Waste, and VentPipe with a Cellular CoreChlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40and 80
ASTM F 891	(1993a) Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core
ASTM F 1290	(1993) Electrofusion Joining Polyolefin Pipe and Fittings

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 34	(1992; Addenda a-j) Number Designation and Safety Classification of Refrigerants
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ASHRAE 90.1	(1989; 90.1b; 90.1c; 90.1d; 90.1e; 90.1g; 90.1i) Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings
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AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.1.2	(1991) Air Gaps in Plumbing Systems
ASME A112.6.1	(1988) Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.14.1	(1991) Air Gaps in Plumbing Systems
ASME A112.18.1M	(1996) Plumbing Fixture Fittings
ASME A112.19.1M	(1994) Enameled Cast Iron Plumbing Fixtures
ASME A112.19.2M	(1995; Errata) Vitreous China Plumbing Fixtures
ASME A112.19.3M	(1987; R 1996) Stainless Steel Plumbing fixtures (Designed for Residential Use)
ASME A112.19.4M	(1994) Porcelain Enameled Formed Steel Plumbing Fixtures
ASME A112.21.1M	(1991) Floor Drains
ASME A112.21.2M	(1983) Roof Drains
ASME A112.36.2M	(1991) Cleanouts
ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.4	(1992) Gray Iron Threaded Fittings
ASME B16.5	(1988; Errata Oct 88; B16.5a) Pipe Flanges and Flanged Fittings Purpose (Inch)
ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.4	(1992) Gray Iron Threaded Fittings
ASME B16.5	(1988; Errata Oct 88; B16.5a) Pipe Flanges and Flanged Fittings
ASME B16.12	(1991) Cast Iron Threaded Drainage Fittings
ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1995) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(1992; Errata Jan 1994) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.24	(1991; Errata) Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500 and 2500, and Flanged Fittings, Class 150 and 300
ASME B16.29	(1994) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV

ASME B16.34	(1988) Valves - Flanged, Threaded, and Welding End
ASME B16.39	(1986; R 1994) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B31.1	(1995) Power Piping
ASME B31.5	(1992; B31.5a) Refrigeration Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPV VIII Div 1	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME BPV IX	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME CSD-1	(1995) Controls and Safety Devices for Automatically Fired Boilers

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1001	(1990) Pipe Applied Atmospheric Type Vacuum Breakers
ASSE 1002	(1964; Rev thru Apr 1986) Water Closet Flush Tank Ball Cocks
ASSE 1003	(1964; Rev thru Oct 1993; Errata Dec 1993) Water Pressure Reducing Valves for Domestic Water Supply Systems
ASSE 1005	(1993) Water Heater Drain Valves - 3/4-Inch Iron Pipe Size
ASSE 1006	(1986) Residential Use (Household) Dishwashers
ASSE 1011	(1995) Hose Connection Vacuum Breakers
ASSE 1012	(1995) Backflow Preventers with Intermediate Atmospheric Vent
ASSE 1013	(1971; Rev thru Oct 1993) Reduced Pressure Principle Backflow Preventers
ASSE 1018	(1977; Rev Jan 1986) Trap Seal Primer Valves Water Supply Fed
ASSE 1037	(1986; Rev thru Mar 1990) Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures/F

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA-01	(1995) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(1992) Hypochlorites
AWWA B301	(1992) Liquid Chlorine
AWWA C105	(1993) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C203	(1991) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C606	(1987) Grooved and Shouldered Joints
AWWA C700	(1995) Cold-Water Meters - Displacement Type, Bronze Main Case
AWWA D100	(1984; D100a) Welded Steel Tanks for Water Storage

AWWA M20	(1973) Manual: Water Chlorination Principles and Practices
AMERICAN WELDING SOCIETY (AWS)	
AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding
AWS B2.2	(1991) Brazing Procedure and Performance Qualification
CAST IRON SOIL PIPE INSTITUTE (CISPI)	
CISPI 301	(1995) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI HSN-85	(1985) Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings
CODE OF FEDERAL REGULATIONS (CFR)	
10 CFR 430	Energy Conservation Program for Consumer Products
21 CFR 175	Indirect Food Additives: Adhesives and Components of Coatings
COMMERCIAL ITEM DESCRIPTIONS (CID)	
CID A-A-238	(Rev B) Seat, Water Closet
CID A-A-240	(Basic) Shower Head, Ball Joint
CID A-A-50012	(Basic) Garbage Disposal Machine, Commercial
COPPER DEVELOPMENT ASSOCIATION (CDA)	
CDA-02	(1995) Copper Tube Handbook
COUNCIL OF AMERICAN BUILDING OFFICIALS (CABO)	
CABO A117.1	(1992; Errata Jun 1993) Accessible and Usable Buildings and Facilities
FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCHR)	
FCCCHR-01	(1993) Manual of Cross-Connection Control
HYDRAULIC INSTITUTE (HI)	
HI 1.1-1.5	(1994) Centrifugal Pumps
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-25	(1993) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-44	(1996) Steel Pipe Line Flanges
MSS SP-58	(1993) Pipe Hangers and Supports -

	Materials, Design and Manufacture
MSS SP-67	(1995) Butterfly Valves
MSS SP-69	(1996) Pipe Hangers and Supports -
	Selection and Application
MSS SP-70	(1990) Cast Iron Gate Valves, Flanged and
	Threaded Ends
MSS SP-71	(1990) Cast Iron Swing Check Valves,
	Flanges and Threaded Ends
MSS SP-72	(1992) Ball Valves with Flanged or
	Butt-welding Ends for General Service
MSS SP-73	(1991) Brazing Joints for Copper and
	Copper Alloy Pressure Fittings
MSS SP-78	(1987; R 1992) Cast Iron Plug Valves,
	Flanged and Threaded Ends
MSS SP-80	(1997) Bronze Gate, Globe, Angle and
	Check Valves
MSS SP-83	(1995) Class 3000 Steel Pipe Unions
	Socket-Welding and Threaded
MSS SP-85	(1994) Cast Iron Globe & Angle Valves,
	Flanged and Threaded Ends
MSS SP-110	(1996) Ball Valves Threaded,
	Socket-Welding, Solder Joint, Grooved and
	Flared Ends

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS
(NAPHCC)

NAPHCC-01	(1996) National Standard Plumbing Code
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NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31	(1992) Installation of Oil Burning Equipment
NFPA 54	(1992) National Fuel Gas Code
NFPA 90A	(1993) Installation of Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF Std 3	(1982) Dishwashing Machine/Commercial Spray Type
NSF Std 5	(1992) Hot Water Generating Equipment
NSF Std 14	(1965; Rev Nov 1990) Plastics Piping Components and Related Materials

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA-01	(1991) Plastic Pipe in Fire Resistive Construction
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PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI G-101 (1991) Testing and Rating Procedures
for Grease Interceptors
PDI WH 201 (1992) Water Hammer Arresters

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE J1508 (1993) Hose Clamps

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 5 (1994) White Metal Blast Cleaning

UNDERWRITERS LABORATORIES (UL)

UL 174 (1996) Household Electric Storage
Tank Water Heaters
UL 430 (1994; Rev Nov 95) Waste Disposers
UL 732 (1995) Oil-Fired Storage Tank Water
Heaters
UL 749 (1995; Rev thru Mar 1996) Household
Dishwashers
UL 921 (1992) Commercial Electric Dishwashers

1.2 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening.

1.3 PERFORMANCE REQUIREMENTS

1.4 ELECTRICAL WORK

Motors, motor controllers and motor efficiencies shall conform to the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Electrical motor-driven equipment specified herein shall be provided complete with motors. Equipment shall be rated at 60 Hz, single phase, ac unless otherwise indicated. Where a motor controller is not provided in a motor-control center on the electrical drawings, a motor controller shall be as indicated. Motor controllers shall be provided complete with properly sized thermal-overload protection in each ungrounded conductor, auxiliary contact, and other equipment, at the specified capacity, and including an allowable service factor.

1.5 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 SD Drawings

Plumbing System; GA;

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operations of each system. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

SD-06 SD Instructions

Plumbing System; GA

Diagrams, instructions, and other sheets proposed for posting. Manufacturer's recommendations for the installation of bell and spigot and hubless joints for cast iron soil pipe.

SD-09 SD Reportst

Tests, Flushing and Sterilization;GA

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Backflow Prevention Assembly Tests; FIO

Certification of proper operation shall be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests. If no state requirement exists, the Contractor shall have the manufacturer's representative test the device, to ensure the unit is properly installed and performing as intended. The Contractor shall provide written documentation of the tests performed and signed by the individual performing the tests.

SD-13 SD Certificates

Materials and Equipment; GA; 15400

Where materials or equipment are specified to comply with requirements of AGA, or ASME, proof of such compliance. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency. Where equipment is specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

1.6 REGULATORY REQUIREMENTS

1.6.1 Plumbing

Plumbing work shall be in accordance with NAPHCC-01.

1.7 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

PART 2 PRODUCT

2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF Std 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW." Polypropylene pipe and fittings shall conform to dimensional requirements of Schedule 40, Iron Pipe size. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing lead shall not be used in any potable water system. Hubless cast-iron soil pipe shall not be installed under concrete floor slabs or in crawl spaces below kitchen floors. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

2.1.1 Pipe Joint Materials

Grooved pipe shall not be used under ground. Joints and gasket materials shall conform to the following:

- a. Coupling for Cast-Iron Pipe: ASTM A 74, AWWA C606.
- b. Coupling for Steel Pipe: AWWA C606.
- c. Couplings for Grooved Pipe: Ductile Iron ASTM A 536 (Grade 65-45-12) Copper ASTM A 536.
- d. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1.6 mm (1/16 inch) thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.
- e. Neoprene Gaskets for Hub and Cast-Iron Pipe and Fittings: CISPI HSN-85.
- f. Brazing Material: Brazing material shall conform to AWS A5.8, BCuP-5.
- g. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain

potassium borides; and contain fluorides. Silver brazing materials shall be in accordance with AWS A5.8.

h. Solder Material: Solder metal shall conform to ASTM B 32 95-5 tin-antimony.

i. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B 813, Standard Test 1.

j. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe, ASTM D 3308.

k. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings: ASTM C 564.

l. Rubber Gaskets for Grooved Pipe: ASTM D 2000, maximum temperature 110 degrees C (230 degrees F)

m. Flexible Elastomeric Seals: ASTM D 3139, ASTM D 3212 or ASTM F 477.

n. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A 183.

o. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D 3138.

p. Plastic Solvent Cement for ABS Plastic Pipe:ASTM D 2235.

q. Plastic Solvent Cement for PVC Plastic Pipe:ASTM D 2564 and ASTM D 2855.

r. Plastic Solvent Cement for CPVC Plastic Pipe:ASTM F 493.

s. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc. shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105. Blind flange material shall conform to ASTM A 516 cold service and ASTM A 515 for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193.

t. Plastic Solvent Cement for Styrene Rubber Plastic Pipe:ASTM D 3122.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

a. Water Hammer Arrestor: PDI WH 201.

b. Copper, Sheet and Strip for Building Construction:ASTM B 370

c. Asphalt Roof Cement: ASTM D 2822.

d. Hose Clamps: SAE J1508.

e. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.

f. Metallic Cleanouts: ASME A112.36.2M.

g. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.

h. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.

i. Hypochlorites: AWWA B300.

j. Liquid Chlorine: AWWA B301.

2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 65 mm (2-1/2 inches) and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 80 mm (3 inches) and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34
Backwater Valves	ASME A112.14.1
Vacuum Relief Valves	ASSE 1001
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASSE 1005
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves	ASME CSD-1 Safety

2.4 Wall Faucets

Wall faucets with vacuum-breaker backflow preventer shall be brass with 20 mm (3/4 inch) male inlet threads, hexagon shoulder, and 20 mm (3/4 inch) hose connection. Faucet handle shall be securely attached to stem.

2.5 Lavatories

Enameled cast-iron lavatories shall be provided with two cast-iron or steel brackets secured to the underside of the apron and drilled for bolting to the wall in a manner similar to the hanger plate. Exposed brackets shall be porcelain enameled. Vitreous china lavatories shall be provided with two integral molded lugs on the back-underside of the fixture and drilled for bolting to the wall in a manner similar to the hanger plate.

2.6 Automatic Flushing System

Flushing system shall consist of solenoid-activated flush valve with electrical-operated light beam sensor to energize solenoid. Flushing devices shall be provided as described in paragraph FIXTURES AND FIXTURE TRIMMINGS.

2.7 BACKFLOW PREVENTERS

Backflow preventers shall be approved and listed by the Foundation For Cross-Connection Control & Hydraulic Research. Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be tested, approved, and listed in accordance with FCCCHR-01. Backflow preventers with intermediate atmospheric vent shall conform to ASSE 1012. Reduced pressure principle backflow preventers shall conform to ASSE 1013. Hose connection vacuum breakers shall conform to ASSE 1011. Pipe applied atmospheric type vacuum breakers shall conform to ASSE 1001. Air gaps in plumbing systems shall conform to ASME A112.1.2.

2.8 DRAINS

2.8.1 Floor and Shower Drains

Floor and shower drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded or caulked connection. In lieu of a caulked joint between the drain outlet and waste pipe, a neoprene rubber

gasket conforming to ASTM C 564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.21.1M.

2.9 WATER HEATER

Water heater types and capacities shall be as indicated. Each primary water heater shall have controls adjustable from 32 to 49 degrees C (90 to 120 degrees F). Each gas-fired water heater and booster water heater shall have controls adjustable from 49 to 82 degrees C (120 to 180 degrees F). Hot water systems utilizing recirculation systems shall be tied into building off-hour controls. The thermal efficiencies and stand by heat losses shall conform to TABLE III for each type of water heater specified. The only exception is that the storage capacity need not meet the standard loss requirement if the tank surface area is not insulated to R-12.5 and if a standing light is not used.

2.9.1 Automatic Storage Type

Heaters shall be complete with control system, and shall have ASME rated combination pressure and temperature relief valve.

2.9.2 Electric Type

Electric type water heaters shall conform to UL 174 with dual heating elements. Each element shall be 4.5 kW. The elements shall be wired so that only one element can operate at a time.

2.10 COMPRESSED AIR SYSTEM

2.10.1 Air Compressors

Air compressor unit shall be a factory-packaged assembly, including 3 phase, volt motor controls, switches, wiring, accessories, and motor controllers, in a NEMA 250, Type 1 enclosure. Tank-mounted air compressors shall be manufactured to comply with UL listing requirements. Air compressors shall have manufacturer's name and address, together with trade name, and catalog number on a nameplate securely attached to the equipment. Each compressor shall start and stop automatically at upper and lower pressure limits of the system. Guards shall shield exposed moving parts. Each compressor motor shall be provided with an across-the-line-type magnetic controller, complete with low-voltage release. An intake air filter and silencer shall be provided with each compressor. Aftercooler and moisture separator shall be installed between compressors and air receiver to remove moisture and oil condensates before the air enters the receiver. Aftercoolers shall be either air- or water-cooled, as indicated. The air shall pass through a sufficient number of tubes to affect cooling. Tubes shall be sized to give maximum heat transfer. Cooling capacity of the aftercooler shall be sized for the total capacity of the compressors. Means shall be provided for draining condensed moisture from the receiver by an automatic float type trap. Capacities of air compressors and receivers shall be as indicated.

2.10.2 Lubricated Compressors

Compressors shall be two-stage, V-belt drive, capable of operating continuously against their designed discharge pressure, and shall operate

at a speed not in excess of 1800 rpm. Compressors shall have the capacity and discharge pressure indicated. Compressors shall be assembled complete on a common subbase. The compressor main bearings shall be either roller or ball. The discharge passage of the high pressure air shall be piped to the air receiver with a copper pipe or tubing. A pressure gauge calibrated to 1.03 MPa (150 psi) and equipped with a gauge cock and pulsation dampener shall be furnished for installation adjacent to pressure switches.

2.10.3 Air Receivers

Receivers shall be designed for 1.38 MPa (200 psi) working pressure. Receivers shall be factory air tested to 1-1/2 times the working pressure. Receivers shall be equipped with safety relief valves and accessories, including pressure gauges and automatic and manual drains. The outside of air receivers may be galvanized or supplied with commercial enamel finish. Receivers shall be designed and constructed in accordance with ASME BPV VIII Div 1 and shall have the design working pressures specified herein. A display of the ASME seal on the receiver or a certified test report from an approved independent testing laboratory indicating conformance to the ASME Code shall be provided.

2.10.4 Intake Air Supply Filter

Dry type air filter shall be provided having a collection efficiency of 99 percent of particles larger than 10 microns. Filter body and media shall withstand a maximum 862 kPa (125 psi), capacity as indicated.

2.10.5 Pressure Regulators

The air system shall be provided with the necessary regulator valves to maintain the desired pressure for the installed equipment. Regulators shall be designed for a maximum inlet pressure of 862 kPa (125 psi) and a maximum temperature of 93 degrees C (200 degrees F). Regulators shall be single-seated, pilot-operated with valve plug, bronze body and trim or equal, and threaded connections. The regulator valve shall include a pressure gauge and shall be provided with an adjustment screw for adjusting the pressure differential from 0 kPa to 862 kPa (0 to 125 psi) Regulator shall be sized as indicated.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Hubless cast-iron pipe shall not be installed under concrete floor slabs. Piping located in air plenums shall conform to NFPA 90A requirements. Unprotected plastic pipe shall not be installed in air plenum. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA-01. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 1.5 m (5 feet) outside the building, unless otherwise indicated. A gate valve and drain shall be installed on the water service line inside the building approximately 150

mm (6 inches) above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 300 mm (12 inches) below the average local frost depth, finish grade or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 15 mm (1/2 inch) between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated

components are furnished to accommodate specific excepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 100 mm (4 inches) and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Pipe Drains

Pipe drains indicated shall consist of 20 mm (3/4 inch) hose bibb with renewable seat and gate valve ahead of hose bibb. At other low points, 20 mm (3/4 inch) brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.1.1.6 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets, changes in direction, etc., where indicated and/or required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 15 m (50 feet) in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

3.1.1.7 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located as generally indicated, with precise location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall conform to PDI WH 201. Vertical capped pipe columns will not be permitted.

3.1.2 Compressed Air Piping (Non-Oil Free)

Compressed air piping shall be installed as specified for water piping and suitable for 862 kPa (125 psig) (125 psig) working pressure. Compressed air piping shall have supply lines and discharge terminals legibly and permanently marked at both ends with the name of the system and the direction of flow.

3.1.3 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be

made up with fittings of compatible material and made for the specific purpose intended.

3.1.3.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.1.3.2 Other Joint Methods

3.1.4 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper pipe shall be made with dielectric unions or flange waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.5 Corrosion Protection for Buried Pipe and Fittings

3.1.6 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.6.1 Sleeve Requirements

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves are not required for cast-iron soil pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve with corrosion-protected carbon steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 100 mm (4 inches) above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 6 mm (1/4 inch) clearance between bare pipe and inside of sleeve or between jacket over insulation and sleeves. Sleeves in bearing walls shall be steel pipe or cast-iron pipe. Sleeves for membrane waterproof floors shall be steel pipe, cast-iron pipe, or plastic pipe. Membrane clamping devices shall be provided on pipe sleeves for waterproof floors. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic. Plastic sleeves shall not be used in

nonbearing fire walls, roofs, or floor/ceilings. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C 920 and with a primer, backstop material and surface preparation as specified in Section 07920 JOINT SEALING. Pipes passing through sleeves in concrete floors over crawl spaces shall be sealed as specified above. The annular space between pipe and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated. Sleeves through below-grade walls in contact with earth shall be recessed 15 mm (1/2 inch) from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and masonry wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant.

3.1.6.2 Flashing Requirements

Pipes passing through roof or floor waterproofing membrane shall be installed through a 4.9 kg per square meter (16 ounce) copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 200 mm (8 inches) from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 250 mm. (10 inches.) For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 200 mm (8 inches) from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 250 mm (10 inches) in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

3.1.6.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 40 mm (1-1/2 inches) to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 40 mm; (1-1/2 inches;) then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 200 mm (8 inches) from the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 40 mm (1-1/2 inches) to fit the outside

diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

3.1.6.4 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

- a. A standard roof coupling for threaded pipe up to 150 mm (6 inches) in diameter.
- b. A tack-welded or banded-metal rain shield around the pipe.

3.1.6.5 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs Flashing Requirements and Waterproofing, a groove 6 to 13 mm (1/4 to 1/2 inch) wide by 6 to 10 mm (1/4 to 3/8 inch) deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in Section 07920 JOINT SEALING.

3.1.7 Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07270 FIRESTOPPING.

3.1.8 Supports

3.1.8.1 General

Hangers used to support piping 50 mm (2 inches) and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run.

3.1.8.2 Pipe Supports and Structural Bracing, Seismic Requirements

Piping and attached valves shall be supported and braced to resist seismic loads as specified Section Structural steel required for reinforcement to properly support piping, headers, and equipment, but not shown, shall be provided. Material used for supports shall be as specified in Section 05120 STRUCTURAL STEEL.

3.1.8.3 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

- a. Types 5, 12, and 26 shall not be used.
- b. Type 3 shall not be used on insulated pipe.
- c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.
- d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
- e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.
- f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.
- g. Type 39 saddles shall be used on insulated pipe 100 mm (4 inches) and larger when the temperature of the medium is 15 degrees C (60 degrees F) or higher. Type 39 saddles shall be welded to the pipe.
- h. Type 40 shields shall:

- (1) Be used on insulated pipe less than 100 mm (4 inches).
- (2) Be used on insulated pipe 100 mm (4 inches)

and larger when the temperature of the medium is 15 degrees C (60 degrees F) or less.

- (3) Have a high density insert for pipe 50 mm (2 inches) and larger and for smaller pipe sizes when the insulation is suspected of being visibly compressed, or distorted at or near the shield/insulation interface. High density inserts shall have a density of 128 kg per cubic meter (8 pcf) or greater.

- i. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 300 mm (1 foot) from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 1.5 m (5 feet) apart at valves. Operating temperatures in determining hanger spacing for PVC or CPVC pipe shall be 49 degrees C (120 degrees F) for PVC and 82 degrees C (180 degrees F) for CPVC. Horizontal pipe runs shall include allowances for expansion and contraction.

- j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 4.5 m (15 feet) nor more than 2 m (8 feet) from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.

- k. Type 40 shields used on insulated pipe shall have high density

inserts with a density of 128 kg per cubic meter (8 pcf) or greater.

1. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:

(1) On pipe 100 mm (4 inches) and larger when the temperature of the medium is 15 degrees C (60 degrees F) or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.

(2) On pipe less than 100 mm (4 inches) a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

(3) On pipe 100 mm (4 inches) and larger carrying medium less than 15 degrees C (60 degrees F) a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

m. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.

n. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 100 mm (4 inches) or by an amount adequate for the insulation, whichever is greater.

o. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

3.1.9 Welded Installation

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.10 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 100 mm (4 inches) will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place

shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 100 mm (4 inches). Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single story buildings with slab-on-grade construction or where less than 450 mm (18 inches) of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron or plastic.

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 150 mm (6 inches) above the top of the tank or water heater.

3.2.2 Heat Traps

Piping to and from each water heater and hot water storage tank shall be routed horizontally and downward a minimum of 600 mm (2 feet) before turning in an upward direction.

3.2.3 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

3.3 FIXTURES AND FIXTURE TRIMMINGS

Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to

mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.3.2 Flushometer Valves

Flushometer valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket. [Flushometer valves for water closets shall be installed 1 m (39 inches) above the floor. Bumpers for water closet seats shall be installed on the wall, flushometer stop.

3.3.3 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 775 mm (31 inches) above finished floor. Wall-hung drinking fountains and water coolers shall be installed with rim 1020 mm (42 inches) above floor. Wall-hung service sinks shall be mounted with rim 700 mm (28 inches) above the floor. Installation of fixtures for use by the physically handicapped shall be in accordance with CABO A117.1.

3.3.4 Fixture Supports

Fixture supports for off-the-floor lavatories, urinals, water closets, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab

3.3.4.1 Support for Solid Masonry Construction

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

3.3.4.2 Support for Cellular-Masonry Wall Construction

Chair carrier shall be anchored to floor slab. Where a floor-anchored

chair carrier cannot be used, a suitable wall plate shall be fastened to the cellular wall using through bolts and a back-up plate

3.3.4.3 Support for Steel Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining steel partition studs are suitably reinforced to support a wall plate bolted to these studs.

3.3.4.4 Support for Wood Stud Construction

Where floor is a concrete slab, a floor-anchored chair carrier shall be used. Where entire construction is wood, wood crosspieces shall be installed. Fixture hanger plates, supports, brackets, or mounting lugs shall be fastened with not less than No. 10 wood screws, 6 mm (1/4 inch) thick minimum steel hanger, or toggle bolts with nut. The wood crosspieces shall extend the full width of the fixture and shall be securely supported.

3.3.4.5 Wall-Mounted Water Closet Gaskets

Where wall-mounted water closets are provided, reinforced wax, treated felt, or neoprene gaskets shall be provided. The type of gasket furnished shall be as recommended by the chair-carrier manufacturer.

3.3.5 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with NAPHCC-01 at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

3.3.6 Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified in Section 05500 MISCELLANEOUS METAL.

3.3.7 Sight Drains

Sight drains shall be installed so that the indirect waste will terminate 50 mm (2 inches) above the flood rim of the funnel to provide an acceptable air gap.

3.3.8 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps installed on plastic pipe may be plastic conforming to ASTM D 3311. Traps for acid-resisting waste shall be of the same material as the pipe.

3.3.9 Color Coding

Color coding for piping identification shall be as specified in Section 09900 PAINTING, GENERAL.

3.4 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.4.1 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09900 PAINTING, GENERAL.

3.5 TESTS FLUSHING AND STERILIZATION

3.5.1 Plumbing System

The plumbing system shall be tested in accordance with NAPHCC-01.

3.5.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies. Gauges shall be tested annually for accuracy in accordance with the University of Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14). Report form for each assembly shall include, as a minimum, the following:

Data on Device	Data on Testing Firm
Type of Assembly	Name
Manufacturer	Address
Model Number	Certified Tester
Serial Number	Certified Tester No.
Size	Date of Test
Location	
Test Pressure Readings	Serial Number and Test Data of Gauges

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

3.5.1.2 Shower Pans

After installation of the pan and finished floor, the drain shall be temporarily plugged below the weep holes. The floor area shall be flooded with water to a minimum depth of 25 mm (1 inch) for a period of 24 hours. Any drop in the water level during test, except for evaporation, will be reason for rejection, repair, and retest.

3.5.1.3 Compressed Air Piping (Nonoil-Free)

Piping systems shall be filled with oil-free dry air or gaseous nitrogen to 1.03 MPa (150 psig) and hold this pressure for 2 hours with no drop in pressure.

3.5.2 Phenolic Resin Coatings

A certificate of compliance shall be submitted by the coating manufacturer that documents successful use of coating system under service conditions indicated on the drawings for a minimum of 2 years at three different locations, and that the coating material and application comply with the testing procedures outlined.

3.5.2.1 Test Panels

Steel test panel substrate shall be 0.607 mm (24 gauge) in thickness. The panels shall be coated with one coat wash primer, then pigmented baking phenolic to a dry film thickness of 0.10 to 0.15 mm, (4 to 6 mil,) then clear baking phenolic to a total dry film thickness of 0.13 to 0.18 mm. (5 to 7 mil.) The panels shall then be subjected to the tests specified below:

a. Heat Test: Test panel shall be minimum 70 x 150 mm (2-3/4 x 5-7/8 inches) in size. A coated test panel shall show no cracking, flaking, or other failure after the panel has been tested in accordance with ASTM D 2485, with a furnace temperature of 204 degrees C (400 degrees F).

b. Abrasion Test: A coated test panel shall show no more than a 40 milligram loss when tested in accordance with ASTM D 4060, utilizing a Tabor Abraser CS-17F wheel with a 1000 g weight for 1000 cycles.

c. Corrosion Test: A coated test panel shall show no corrosion after being subjected to a 500 hour salt spray test in accordance with ASTM B 117.

3.5.3 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be permitted.

3.5.4 System Flushing

After tests are completed, potable water piping shall be flushed. In general, sufficient water shall be used to produce a minimum water velocity of 0.762 meters per second (2.5 feet per second) through piping being flushed. Flushing shall be continued until discharge water shows no

discoloration. System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced in line. After flushing and cleaning, systems shall be prepared for service by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the work is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation.

3.5.5 Operational Test

Upon completion of and prior to acceptance of the installation, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

- a. Time, date, and duration of test.
 - b. Water pressures at the most remote and the highest fixtures.
 - c. Operation of each fixture and fixture trim.
 - d. Operation of each valve, hydrant, and faucet.
 - e. Pump suction and discharge pressures.
 - f. Temperature of each domestic hot-water supply.
 - g. Operation of each floor and roof drain by flooding with water.
 - h. Operation of each vacuum breaker and backflow preventer.
 - i. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.
 - j. Compressed air readings at each compressor and at each outlet.
- Each indicating instrument shall be read at 1/2 hour intervals. The report of the test shall be submitted in quadruplicate. The Contractor shall furnish instruments, equipment, and personnel required for the tests; the Government will furnish the necessary water and electricity.

3.5.6 Disinfection

After pressure tests have been made, the entire domestic hot- and cold-water distribution system shall be sterilized. System shall be thoroughly flushed with water of sufficient velocity until all entrained dirt and other foreign material have been removed, before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main

through a solution-feed chlorinator and booster pump, shall be used. The chlorine residual shall be checked at intervals to ensure that the proper level is maintained. Chlorine application shall continue until the entire main is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system being sterilized shall be opened and closed several times during the contact period to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. Water tanks shall be disinfected by the addition of chlorine directly to the filling water. Following a 6 hour period, no less than 50 ppm chlorine residual shall remain in the tank. The system including the tanks shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. During the flushing period each valve and faucet shall be opened and closed several times. From several points in the system the Contracting Officer will take samples of water in properly sterilized containers for bacterial examination. The samples of water shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA-01. The testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique. The sterilizing shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.6 PLUMBING FIXTURE SCHEDULE

P-1 WATER CLOSET:

Siphon-jet, elongated bowl, top supply spud, ASME A112.19.2M, [floor mounted . Floor flange shall be copper alloy, cast iron, or plastic. Gasket shall be wax type. Seat - CID A-A-238, Type A, black, white, plastic, elongated, open front. Flushometer Valve - ASSE 1037, large diaphragm type with non-hold-open feature, backcheck angle control stop, and vacuum breaker. Minimum upper chamber inside diameter of not less than 66.7 mm (2-5/8 inches) at the point where the diaphragm is sealed between the upper and lower chambers. The maximum water use shall be 6 liters (1.6 gallons) per flush.

P-2 URINAL:

Wall hanging, with integral trap and extended shields, ASME A112.19.2M siphon jet. Top supply connection, back outlet. Flushometer Valve - Similar to Flushometer Valve for P-1. The maximum water use shall be 3.8 liters (1 gallon) per flush.

P-3 LAVATORY:

Manufacturer's standard sink depth, enameled cast iron ASME A112.19.1M ledge back, rectangular. Faucet - Faucets shall be single control, mixing type. Faucets shall have metal replaceable cartridge control unit or metal cartridge units with diaphragm which can be replaced without special tools. Valves and handles shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing. Flow shall be limited to 1 liter (0.25 gallon) per cycle at a flowing water pressure of 549 kPa (80 psi) if a metering device or fitting is used that limits the period of water discharge such as a foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 0.16 liters per second (2.5 gpm) at a flowing pressure of 549 kPa. (80 psi.)

Handles - Crown type. Cast, formed, or drop forged copper alloy.
Drain - [Strainer shall be copper alloy or stainless steel] [Pop-up drain shall include stopper, lift rods, jam nut, washer, and tail piece]. See paragraph FIXTURES for optional plastic accessories.

P-4 KITCHEN SINK:

Ledge back with holes for faucet and spout single bowl 609.6 x 533.4 mm (24 x 21 inches) stainless steel ASME A112.19.3M. Faucet and Spout - Cast or wrought copper alloy. Aerator shall have internal threads. Flow shall be limited to 1 liter (0.25 gallon) metering device or fitting is used that limits the period of water discharge such as a foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 0.16 liters per second (2.5 gpm) at a flowing water pressure of 549 kPa. (80 psi.) Handle - Cast copper alloy, wrought copper alloy, or stainless steel. Single lever type. Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc. shall be copper alloy or stainless steel.

P-5 SERVICE SINK:

Enameled cast iron ASME A112.19.1M, copper alloy or stainless steel ASME A112.19.3M trap standard 609.6 mm wide x 508.0 mm deep (24 inches wide x 20 inches deep), splashback 228.6 mm (9 inches) high. Faucet and Spout - Cast or wrought copper alloy, with top or bottom brace, with backflow preventer. Faucets shall have replaceable seat and the washer shall rotate onto the seat. Handles shall be lever type. Strainers shall have internal threads. Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc. shall be copper alloy or stainless steel. Trap - Cast iron, minimum 7.5 cm (3 inch) diameter.

P-15 WATER COOLER DRINKING FOUNTAINS:

Water cooler drinking fountains shall: be self contained, conform to ARI 1010, use one of the fluorocarbon gases conforming to ARI 700 and ASHRAE 34 which has an Ozone Depletion Potential of less than or equal to 0.05, have a capacity to deliver 30.2 liters per hour (8 gph) of water at 10 degrees C (50 degrees F) with an inlet water temperature of 27 degrees C (80 degrees F) while residing in a room environment of 32 degrees C (90 degrees F), and have self-closing valves. Self-closing valves shall have automatic stream regulators, have a flow control capability, have a push button actuation or have a cross-shaped index metal turn handle without a hood. Exposed surfaces of stainless steel shall have No. 4 general polish finish. Spouts shall provide a flow of water at least 100 mm (4 inches) high so as to allow the insertion of a cup or glass under the flow of water. Interior Free Standing - Free standing units shall be 1016 to 1054.1 mm (40 to 41-1/2 inches) high, 304.8 to 457.2 mm (12 to 18 inches) wide, and 304.8 to 355.6 mm (12 to 14 inches) deep. The bowl shall be made of corrosion resisting steel and be for interior installation.

3.7 Pool Heaters

Gas/oil fuel, capacities and inputs: ET shall be 78 percent per ANSI Z21.56.

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

SERVICE

Item No.	Pipe and Fitting Materials	A	B	C	D	E	F
01	Cast iron soil pipe and fittings, hub and spigot, ASTM A 74 with compression gaskets	X	X	X	X	X	
02	Cast iron pipe and fittings hubless, CISPI 301 and ASTM A 888	X	X	X	X		
03	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 6	X		X	X		
04	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 6				X	X	
05	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 06				X	X	
06	Steel pipe, seamless galvanized, ASTM A 53, Type S, Grade B	X			X	X	
07	Cast bronze threaded fittings, ASME B16.15				X	X	
08	Copper drainage tube, (DWV), ASTM B 306	X*	X	X*	X	X	
09	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X	X	
10	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	X	X	
11	Acrylonitrile-Butadiene-Styrene (ABS) X plastic drain, waste, and vent pipe and fittings ASTM D 2661, ASTM F 628	X	X	X	X	X	
12	Polyvinyl Chloride plastic drain, X waste and vent pipe and fittings, ASTM D 2665, ASTM F 891, (Sch 40)	X	X	X	X	X	

SERVICE:

A - Underground Building Soil, Waste and Storm Drain
 B - Aboveground Soil, Waste, Drain In Buildings
 C - Underground Vent
 D - Aboveground Vent
 E - Interior Rainwater Conductors Aboveground
 F - Corrosive Waste And Vent Above And Belowground
 * - Hard Temper

TABLE II
 PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

SERVICE

Item No.	Pipe and Fitting Materials	A	B	C	D
01	Malleable-iron threaded fittings, a. Galvanized, ASME B16.3 for use with Item 4a	X	X	X	X
02	Steel pipe: a. Seamless, galvanized, ASTM A 53, Type S, Grade B	X	X	X	X
03	Seamless copper water tube, X*** ASTM B 88	X**	X**	X**	
04	Cast bronze threaded fittings, ASME B16.15 for use with Item 3	X	X		X
05	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Item 5	X	X	X	X
06	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Item 3	X	X	X	X
07	Polyvinyl chloride (PVC) plastic pipe fittings, Schedule 40, ASTM D 2466	X			X
08	Socket-type polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D 2467	X			X
09	Threaded polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D 2464	X			X
10	Joints for IPS pvs pipe using solvent cement, ASTM D 2672	X			X

11	Filament-wound reinforced thermosetting resin (RTRP) pipe, ASTM D 2996	X	X	
12	Fittings: brass or bronze; ASME B16.15, and ASME B16.18 ASTM B 828	X	X	
13	Malleable-iron threaded pipe unions ASME B16.39	X	X	
14	Nipples, pipe threaded ASTM A 733	X	X	X

A - Cold Water Aboveground

B - Hot Water 82 degree C (180 degrees F) Maximum Aboveground

C - Compressed Air Lubricated

D - Cold Water Service Belowground

Indicated types are minimum wall thicknesses.

** - Type L - Hard

*** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors

**** - In or under slab floors only brazed joints

TABLE III
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT

A. STORAGE WATER HEATERS

STORAGE CAPACITY FUEL LITERS PERFORMANCE	INPUT	RATING	TEST PROCEDURE	REQUIRED
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Elect. 454 max. minimum		12 kW max.	10 CFR 430	EF = 0.95-0.00132V
Elect. 454 min. TERMS:	OR	12 kW min.	ASHRAE 90.1	SL = 1.9 W/0.09 sq.

EF = Energy factor, overall efficiency.

ET = Thermal efficiency with 21 degrees C delta T.

EC = Combustion efficiency, 100 percent - flue loss when smoke = 0 (trace is permitted).

SL = Standby loss in W/0.09 sq. m. based on 27 degrees C delta T, or in percent per hour based on nominal 32 degrees C delta T.

HL = Heat loss of tank surface area
V = Storage volume in gallons

-- End of Section --

SECTION 15488

GAS PIPING SYSTEMS

07/9 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications of the latest edition listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN GAS ASSOCIATION (AGA)

AGA-01 (1989) A.G.A. Plastic Pipe Manual for Gas Service

AMERICAN NATIONAL STANDARDS

ANSI Z21.45 (1992; Z21.4a; Z21.4b) Flexible Connectors of Other Than All-Metal Construction for Gas Appliances

ANSI Z21.69 (1992; Z21.69a) Connectors for Movable Gas Appliances

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 6D (1994) Specification for Pipeline Valves (Gate, Plug, Ball, and Check Valves)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 539 (1990a) Electric-Resistance-Welded Coiled Steel Tubing for Gas and Fuel Oil Lines

ASTM B 88 (1995a) Seamless Copper Water Tube

ASTM B 210 (1995) Aluminum and Aluminum-Alloy Drawn Seamless Tubes

ASTM B 241 (1995a) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube

ASTM B 280 (1993a) Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

ASTM D 2513 (1995c) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings

ASTM D 2517 (1981; R 1987) Reinforced Epoxy Resin Gas Pressure Pipe and Fittings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1 (1983; R 1992) Pipe Threads, General Purpose (Inch)

ASME B16.3 (1992) Malleable Iron Threaded Fittings

ASME B16.5	(1988; Errata Oct 88; B16.5a) Pipe Flanges and Flanged Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1991) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.33	(1990) Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (Sizes 1/2 through 2)
ASME B31.1	(1995) Power Piping
ASME B31.2	(1968) Fuel Gas Piping
ASME B36.10M	(1985; R 1994) Welded and Seamless Wrought Steel Pipe
ASME BPV IX	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(1993) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS P-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS P-69	(1991) Pipe Hangers and Supports - Selection and Application

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(1992) National Fuel Gas Code
NFPA 70	(1996) National Electrical Code

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 6	(1994) Commercial Blast Cleaning
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UNDERWRITERS LABORATORIES (UL)

UL-06	(1994; Supple; Rev thru March 1996) Gas and Oil Equipment Directory
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1.2 GENERAL REQUIREMENTS

1.2.1 Welding

Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified at least 24 hours in advance of tests and the tests shall be performed at the work site if practicable. The Contracting Officer shall be furnished with a copy of qualified procedures and a list of names and identification symbols of qualified welders and

welding operators. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Section 05055 WELDING, STRUCTURAL.

1.2.2 Jointing Thermoplastic and Fiberglass Piping

Piping shall be jointed by performance qualified joiners using qualified procedures in accordance with AGA-01. Plastic Pipe Manual for Gas Service. The Contracting Officer shall be furnished with a copy of qualified procedures and list of and identification symbols of qualified joiners.

1.2.3 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Asbestos or products containing asbestos shall not be used. Manufacturer's descriptive data and installation instructions shall be submitted for approval for compression-type mechanical joints used in joining dissimilar materials and for insulating joints. Valves, flanges and fittings shall be marked in accordance with MSS SP-25

1.2.4 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 SD Data

Gas Piping System; GA; 15488

Drawings showing location, size and all branches of pipeline; location of all required shutoff valves; and instructions necessary for the installation of connectors and supports.

PART 2 PRODUCT

2.1 PIPE AND FITTINGS

2.1.1 Steel Pipe, Joints, and Fittings

Steel pipe shall conform to ASME B36.10M. Malleable-iron threaded fittings shall conform to ASME B16.3. Steel pipe flanges and flanged fittings including bolts, nuts, and bolt pattern shall be in accordance with ASME B16.5. Wrought steel butt welding fittings shall conform to ASME B16.9. Socket welding and threaded forged steel fittings shall conform to ASME B16.11.

2.1.2 Identification

Pipe flow markings and metal tags shall be provided as required.

2.1.3 Pipe Threads

Pipe threads shall conform to ASME B1.20.1

2.1.4 Escutcheons

Escutcheons shall be chromium-plated steel or chromium-plated brass, either one piece or split pattern, held in place by internal spring tension or set screw.

2.1.5 Insulating Pipe Joints

2.1.5.1 Insulating Joint Material

Insulating joint material shall be provided between flanged or threaded metallic pipe systems where shown to control galvanic or electrical action.

2.1.5.2 Threaded Pipe Joints

Joints for threaded pipe shall be steel body nut type dielectric unions with insulating gaskets.

2.1.6 Flexible Connectors

Flexible connectors for connecting gas utilization equipment to building gas piping shall conform to ANSI Z21.45. Flexible connectors for movable food service equipment shall conform to ANSI Z21.69.

2.2 VALVES

Valves shall be suitable for shutoff or isolation service and shall conform to the following:

2.2.1 Valves 50 mm (2 Inches) and Smaller

Valves 50 mm (2 inches) and smaller shall conform to ASME B16.33 and shall be of materials and manufacture compatible with system materials used.

2.2.2 Valves

65 mm (2-1/2 Inches) and Larger Valves 65 mm (2-1/2 inches) and larger shall be carbon steel conforming to API Spec 6D, Class 150.

2.3 PIPE HANGERS AND SUPPORTS

Pipe hangers and supports shall conform to MSS SP-58 and MSS SP-69

PART 3 EXECUTION

3.1 EXCAVATION AND BACKFILLING

Earthwork shall be as specified in Section 02222 EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES SYSTEMS.

3.2 GAS PIPING SYSTEM

Gas piping system shall be from the point of delivery, defined as the outlet of the L. P. G. Tank regulator, specified in Section 02685 GAS DISTRIBUTION SYSTEM, to the connections to each gas utilization device.

3.2.1 Protection of Materials and Components

Pipe and tube openings shall be closed with caps or plugs during installation. Equipment shall be protected from dirt, water, and chemical or mechanical damage. At the completion of all work, the entire system shall be thoroughly cleaned.

3.2.2 Workmanship and Defects

Piping, tubing and fittings shall be clear and free of cutting burrs and defects in structure or threading and shall be thoroughly brushed and chip-and scale-blown. Defects in piping, tubing or fittings shall not be repaired. When defective piping, tubing, or fittings are located in a system, the defective material shall be replaced.

3.3 PROTECTIVE COVERING

3.3.1 Underground Metallic Pipe

Buried metallic piping shall be protected from corrosion with protective coatings. When dissimilar metals are joined underground, gastight insulating fittings shall be used.

3.3.2 Aboveground Metallic Piping System

3.3.2.1 Ferrous Surfaces

Shop primed surfaces shall be touched up with ferrous metal primer. Surfaces that have not been shop primed shall be solvent cleaned. Surfaces that contain loose rust, loose mill scale and other foreign substances shall be mechanically cleaned by power wire brushing and primed with ferrous metal primer. Primed surface shall be finished with two coats of exterior oil paint.

3.3.2.2 Nonferrous Surfaces

Except for aluminum alloy pipe, nonferrous surfaces shall not be painted. Surfaces of aluminum alloy pipe and fittings shall be painted to protect against external corrosion where they contact masonry, plaster, insulation, or are subject to repeated wettings by such liquids as water, detergents or sewage. The surfaces shall be solvent-cleaned and treated with vinyl type wash coat. A first coat of aluminum paint and a second coat of alkyd gloss

enamel or silicone alkyd copolymer enamel shall be applied.

3.4 INSTALLATION

Installation of the gas system shall be in conformance with the manufacturer's recommendations and applicable provisions of NFPA 54, AGA-01, and as indicated. Pipe cutting shall be done without damage to the pipe. Unless otherwise authorized, cutting shall be done by an approved type of mechanical cutter. Wheel cutters shall be used where practicable.

3.4.1 Metallic Piping Installation

Underground piping shall be buried a minimum of 450 mm(18 inches) below grade. Changes in direction of piping shall be made with fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains.

3.4.2 Aboveground Piping

Aboveground piping shall be run as straight as practicable along the alignment indicated and with a minimum of joints. Piping shall be separately supported. 150 mm(6 inches)

3.4.3 Final Gas Connections

Unless otherwise specified herein, final connections shall be made with rigid metallic pipe and fittings. Flexible connectors may be used for final connections to gas utilization equipment. In addition to cautions listed in instructions required by ANSI standards for flexible connectors, insure that flexible connectors do not pass through equipment cabinet.] Provide accessible gas shutoff valve and coupling for each gas equipment item.

3.5 PIPE JOINTS

Pipe joints shall be designed and installed to effectively sustain the longitudinal pull-out forces caused by contraction of the piping or superimposed loads.

3.5.1 Threaded Metallic Joints

Threaded joints in metallic pipe shall have tapered threads evenly cut and shall be made with UL approved graphite joint sealing compound for gas service or tetrafluoroethylene tape applied to the male threads only. Threaded joints up to 40 mm (1-1/2 inches) in diameter may be made with approved tetrafluoroethylene tape. Threaded joints up to 50 mm (2 inches) in diameter may be made with approved joint sealing compound. After cutting and before threading, pipe shall be reamed and burrs shall be removed. Caulking of threaded joints to stop or prevent leaks shall not be permitted.

3.5.2 Thermoplastic and Fiberglass Joints

Jointing procedures shall conform to AGA-01. Solvent cement or heat of fusion joints shall not be made between different kinds of plastics.

3.5.3 Flared Metallic Tubing Joints

Flared joints in metallic tubing shall be made with special tools recommended by the tubing manufacturer. Flared joints shall be used only in systems constructed from nonferrous pipe and tubing, when experience or tests have demonstrated that the joint is suitable for the conditions, and when adequate provisions are made in the design to prevent separation of the joints. Metallic ball sleeve compression-type tubing fittings shall not be used for tubing joints.

3.6 PIPE SLEEVES

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall not be installed in structural members except where indicated or approved. All rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective wall, floor or roof, and shall be cut flush with each surface, except in mechanical room floors not located on grade where clamping flanges or riser pipe clamps are used. Sleeves in mechanical room floors above grade shall extend at least 100 mm (4 inches) above finish floor. Unless otherwise indicated, sleeves shall be large enough to provide a minimum clearance of 6.4 mm (1/4 inch) all around the pipe. Sleeves in bearing walls, waterproofing membrane floors, and wet areas shall be steel pipe. Sleeves in nonbearing walls, floors, or ceilings may be steel pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic. For penetrations of fire walls, fire partitions and floors which are not on grade, the annular space between the pipe and sleeve shall be sealed with firestopping material and sealant that meet the requirement of Section 07270 FIRESTOPPING.

3.7 FIRE SEAL

Penetrations of fire rated partitions, walls and floors shall be in accordance with Section 07270 FIRESTOPPING.

3.8 ESCUTCHEONS

Escutcheons shall be provided for all finished surfaces where gas piping passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms.

3.9 SPECIAL REQUIREMENTS

Drips, grading of the lines, freeze protection, and branch outlet locations shall be as shown and shall conform to the requirements of NFPA 54.

3.10 BUILDING STRUCTURE

Building structure shall not be weakened by the installation of any gas piping. Beams or joists shall not be cut or notched.

3.11 PIPING SYSTEM SUPPORTS

Gas piping systems in buildings shall be supported with pipe hooks, metal pipe straps, bands or hangers suitable for the size of piping or tubing. Gas piping system shall not be supported by other piping. Spacing of supports in gas piping and tubing installations shall conform to the requirements of NFPA 54. The selection and application of supports in gas piping and tubing installations shall conform to the requirements of MSS SP-69. A clearance of 3.2 mm (1/8 inch) shall be provided between the pipe and clip or clamp for all piping which may be subjected to thermal expansion.

3.12 ELECTRICAL BONDING AND GROUNDING

A gas piping system within a building shall be electrically continuous and bonded to a grounding electrode as required by NFPA 70.

3.13 SHUTOFF VALVE

Main gas shutoff valve controlling the gas piping system shall be easily accessible for operation and shall be installed as indicated, protected from physical damage, and marked with a metal tag to clearly identify the piping system controlled.

3.14 CATHODIC PROTECTION

Cathodic protection shall be provided for underground ferrous gas piping as specified in Section 16640 CATHODIC PROTECTION SYSTEM SACRIFICIAL ANODE]

3.15 TESTING

Before any section of a gas piping system is put into service, it shall be carefully tested to assure that it is gastight. Prior to testing, the system shall be blown out, cleaned and cleared of all foreign material. Each joint shall be tested by means of an approved gas detector, soap and water, or an equivalent nonflammable solution. Testing shall be completed before any work is covered, enclosed, or concealed. All testing of piping systems shall be done with due regard for the safety of employees and the public during the test. Bulkheads, anchorage and bracing suitably designed to resist test pressures shall be installed if necessary. Oxygen shall not be used as a testing medium.

3.15.1 Pressure Tests

Before appliances are connected, piping systems shall be filled with air or an inert gas and shall withstand a minimum pressure of 21 kPa (3 psi) gauge for a period of not less than 10 minutes as specified in NFPA 54 without showing any drop in pressure. Oxygen shall not be used. Pressure shall be measured with a mercury manometer, slope gauge, or an equivalent device so calibrated as to be read in increments of not greater than 1 kPa (0.1 pound). The source of pressure shall be isolated before the pressure tests are made.

3.15.2 Pressure Tests for Liquified Petroleum Gas

Systems shall withstand the pressure test described above. When appliances are connected to the piping system, fuel gas shall be used for testing and appliances shall withstand a pressure of not less than 2.5 kPa nor more

than 3.5 kPa for a period of not less than 10 minutes without showing any drop in pressure. Pressure shall be measured with a water manometer or an equivalent device calibrated to be read in increments of not greater than 20 Pa (0.1 inch water column).

The source of pressure shall be isolated before the pressure tests are made.

3.15.3 Test With Gas

Before turning gas under pressure into any piping, all openings from which gas can escape shall be closed. Immediately after turning on the gas, the piping system shall be checked for leakage by using a laboratory-certified gas meter, an appliance orifice, a manometer, or equivalent device. All testing shall conform to the requirements of NFPA 54. If leakage is recorded, the gas supply shall be shut off, the leak shall be repaired, and the tests repeated until all leaks have been stopped.

3.15.4 Purging

After testing is completed, and before connecting any appliances, all gas piping shall be fully purged. LPG piping tested using fuel gas with appliances connected does not require purging. Piping shall not be purged into the combustion chamber of an appliance. The open end of piping systems being purged shall not discharge into confined spaces or areas where there are ignition sources unless the safety precautions recommended in NFPA 54 are followed.

3.15.5 Labor, Materials and Equipment

All labor, materials and equipment necessary for conducting the testing and purging shall be furnished by the Contractor.

-- End of Section --

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SECTION 15569

WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20 MBTUH
07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 801 (1992) Industrial Process/Power Generation
Fans: Specification Guidelines

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.13 (1991; Z21.13a; Z21.13b) Gas-Fired
Low-Pressure Steam and Hot Water Boilers

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47 (1990) Ferritic Malleable Iron Castings

ASTM A 53 (1995a) Pipe, Steel, Black and Hot-Dipped,
Zinc-Coated Welded and Seamless

ASTM A 105 (1997) Forgings, Carbon Steel, for Piping
Components

ASTM A 106 (1994) Seamless Carbon Steel Pipe for
High-Temperature Service

ASTM A 167 (1996) Stainless and Heat-Resisting
Chromium-Nickel Steel Plate, Sheet, and
Strip

ASTM A 183 (1983, R 1990) Carbon Steel Track Bolts and
Nuts

ASTM A 193 (1996) Alloy-Steel and Stainless Steel
Bolting Materials for High-Temperature
Service

ASTM A 234 (1996) Piping Fittings of Wrought Carbon
Steel and Alloy Steel for Moderate and
Elevated Temperatures

ASTM A 366 (1991; R 1993) Steel, Sheet, Carbon,
Cold-Rolled, Commercial Quality

ASTM A 515	(1992) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A 516	(1990) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM A 653	(1995) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 32	(1995a) Solder Metal
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 75	(1993) Seamless Copper Tube
ASTM B 88	(1996) Seamless Copper Water Tube
ASTM B 813	(1993) Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
ASTM B 828	(1992) Making Capillary Joints by Soldering of Copper and Copper-Alloy Tube and Fittings
ASTM C 27	(1993) Fireclay and High-Alumina Refractory Brick
ASTM C 34	(1993) Structural Clay Load-Bearing Wall Tile
ASTM C 155	(1988; R 1992) Classification of Insulating Firebrick
ASTM C 401	(1991) Alumina and Alumina Silicate Castable Refractories
ASTM D 596	(1991) Reporting Results of Analysis of Water
ASTM D 1784	(1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2000	(1990; R 1994) Rubber Products in Automotive Applications
ASTM F 872	(1984; R 1990) Filter Units, Air Conditioning: Viscous-Impingement Type, Cleanable

ASTM F 1097	(1991) Mortar, Refractory (High-Temperature, Air-Setting)
ASTM F 1139	(1988; R 1993) Standard Specification for Steam Traps and Drains
AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)	
ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.4	(1992) Gray Iron Threaded Fittings
ASME B16.5	(1988; Errata Oct 88; B16.5a) Pipe Flanges and Flanged Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1991) Forged Fittings, Socket-Welding and Threaded
ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1989) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.34	(1988) Valves - Flanged, Threaded and Welding End
ASME B16.39	(1986; R 1994) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B19.3	(1991; B19.3a; B19.3b) Safety Standard for Compressors for Process Industries
ASME B31.1	(1995) Power Piping
ASME B31.5	(1992; B31.5a) Refrigeration Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPV IV	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section IV, Heating

Boilers

ASME BPV VIII Div 1	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME BPV IX	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME CSD-1	(1992; CSD-1a; CSD-1b) Controls and Safety Devices for Automatically Fired Boilers
ASME PTC 10	(1965; Errata; R 1992) Compressors and Exhausters

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C606	(1987) Grooved and Shouldered Joints
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AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding
AWS B2.2	(1991) Brazing Procedure and Performance Qualification

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1419	(Rev D) Filter Element, Air Conditioning (Viscous-Impingement and Dry Types, Replaceable)
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COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA 404/0 RR	(1993) Copper Tube for Plumbing, Heating, Air Conditioning and Refrigeration
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EXPASION JOINT MANUFACTURERS ASSOCIATION (EJMA)

EJMA-01	(1993) EJMA Standards
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HYDRONICS INSTITUTE (HYI)

HYI-01	(1996) I=B=R Ratings for Boilers, Baseboard Radiation and Finned Tube (Commercial) Radiation
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MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(1993) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture

MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1990) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1990) Cast Iron Swing Check Valves, Flanges and Threaded Ends
MSS SP-72	(1992) Ball Valves with Flanged or Butt-welding Ends for General Service
MSS SP-73	(1991) Brazing Joints for Copper and Copper Alloy Pressure Fittings
MSS SP-78	(1987; R 1992) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(1987) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(1994) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
MSS SP-110	(1992) Ball Valves Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31	(1992) Installation of Oil Burning Equipment
NFPA 54	(1992) National Fuel Gas Code
NFPA 70	(1996) National Electrical Code
NFPA 85C	(1991) Prevention of Furnace Explosions/Implosions in Multiple Burner Boiler-Furnaces
NFPA 211	(1992) Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances
NFPA 8501	(1992) Single Burner Boiler Operations

UNDERWRITERS LABORATORIES (UL)

UL-06	(1996) Gas and Oil Equipment Directory
UL 296	(1994; Rev Aug 1995) Oil Burners

UL 726	(1995) Oil-Fired Boiler Assemblies
UL 795	(1994; Rev Jan 1996) Commercial-Industrial Gas Heating Equipment
UL 1738	(1993) Venting Systems for Gas-Burning Appliances, Categories II, III and IV

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

1.2.2 Asbestos Prohibition

Asbestos and asbestos-containing products shall not be used.

1.2.3 Nameplates

Each major component of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the equipment. Each pressure vessel shall have an approved ASME stamp.

1.2.4 Equipment Guards

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded in accordance with OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified. Catwalks, operating platforms, ladders, and guardrails shall be provided where shown and shall be constructed in accordance with Section 05500 MISCELLANEOUS METAL.

1.2.5 Verification of Dimensions

The Contractor shall become familiar with details of the work, verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work or ordering any materials.

1.2.6 Welding

Boilers and piping shall be welded and brazed in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practical. The welder or

welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Section 05055 WELDING, STRUCTURAL. Welding and nondestructive testing procedures for piping are specified in Section 15052 WELDING PRESSURE PIPING.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Catalog Data; GA

Manufacturer's catalog data shall be included with the detail drawings for the following items:

Boilers

Pumps

The data shall show model, size, options, etc., that are intended for consideration. Data submitted shall be adequate to demonstrate compliance with contract requirements.

Spare Parts Data; FIO

Spare parts data for each different item of material and equipment, after approval of the detail drawings and no later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 and 3 years of service.

Heating and Fuel Systems Test Procedures; GA.

Proposed test procedures for the heating system tests and fuel system tests, at least 2 weeks prior to the start of related testing.

Welding Procedures; GA

A copy of qualified welding procedures, at least 2 weeks prior to the start of welding operations.

Qualification; FIO

A statement from the firms proposed to prepare submittals and perform installation and testing, demonstrating successful completion of similar services of at least five projects of similar size or scope, at least 2 weeks prior to the submittal of any other item required by this section.

Welding Qualification; FIO.

A list of names and identification symbols of qualified welders and welding operators, at least 2 weeks prior to the start of welding operations.

SD-04 Drawings

Heating System; GA.

Detail drawings consisting of equipment layout including installation details and electrical connection diagrams; combustion and safety control diagrams; ductwork layout showing the location of supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications; and piping layout showing the location of guides and anchors, the load imposed on each support or anchor, and typical support details. Drawings shall include any information required to demonstrate that the system has been coordinated and will properly function as a unit and shall show equipment relationship to other parts of the work, including clearances required for operation and maintenance.

SD-06 Instructions

Posted Instructions; GA

System layout diagrams that show the layout of equipment, piping, and ductwork and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system, framed under glass or laminated plastic, at least 2 weeks prior to the start of related testing. After approval, these items shall be posted where directed.

SD-07 Schedules

Tests; FIO

Proposed test schedules for the heating system and fuel system tests, at least 2 weeks prior to the start of related testing.

SD-09 Reports

Heating System and Fuel System Tests; GA

Test reports for the heating system tests and the fuel system test, upon completion of testing complete with results.

SD-13 Certificates

Bolts; FIO

Written certification by the bolt manufacturer that the bolts furnished comply with the requirements of this specification. The certification shall include illustrations of product markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

Boiler Emissions; FIO

Written certification by the boiler manufacturer that each boiler furnished complies with Federal, state, and local regulations for emissions. The certification shall also include a description of applicable emission

regulations. If any boiler is exempt from the emission regulations, the certification shall indicate the reason for the exemption.

SD-19 Operation and Maintenance Manuals

Heating System; FIO

Ten complete manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, simplified wiring and control diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

1.4 MANUFACTURER'S SERVICES

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installing, adjusting, and testing of the equipment.

1.5 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be protected from the weather, humidity and temperature variations, dirt and dust, and other contaminants.

PART 2 PRODUCTS

2.1 BOILERS

Each boiler shall have the output capacity in British thermal units per hour (Btuh) as indicated when fired with the specified fuels. The boiler shall be furnished complete with the gas burning equipment, boiler fittings and trim, automatic controls, forced draft fan electrical wiring, insulation, piping connections, and protective jacket. The boiler shall be completely assembled and tested at the manufacturer's plant. Boiler auxiliaries including fans, motors, drives, and similar equipment shall be provided with at least 10 percent excess capacity to allow for field variations in settings and to compensate for any unforeseen increases in pressure losses in appurtenant piping and ductwork. However, the boiler safety devices shall not be sized for a 10 percent excess capacity. The boiler and its accessories shall be designed and installed to permit ready accessibility for operation, maintenance, and service. Boilers shall be designed, constructed, and equipped in accordance with ASME BPV IV. Each boiler shall be of the watertube type and designed for water service as specified herein. The boiler capacity shall be based on the ratings shown in HYI-01 or as certified by the American Boiler Manufacturers Association, or American Gas Association.

2.1.1 Hot Water Heating Boilers

The hot water heating boiler shall be capable of operating at the specified maximum continuous capacity without damage or deterioration to the boiler, its setting, firing equipment, or auxiliaries. The rated capacity shall be

the capacity at which the boiler will operate continuously while maintaining at least the specified minimum efficiency. The boiler design conditions shall be as follows:

- a. Boiler design pressure 160 psig.
- b. Operating pressure at boiler outlet 30 psig.
- c. Hot water temperature 180 degrees F.
- d. Temperature differential between boiler discharge and system return 40 degrees F.
- e. Water pressure drop 5 psig.
- f. Outdoor ambient air temperature 100 degrees F (max), 19 degrees F (min).
- g. Site elevation 3918 feet
- h. Rated output capacity 400,000 Btuh.
- i. Maximum exhaust stack temperature 260 degrees F.
- j. Gas fired boilers with a capacity of greater than or equal to 300,000 Btuh shall have a combustion efficiency of at least 80 percent when fired at the maximum and minimum ratings allowed by the controls.

2.2 FUEL BURNING EQUIPMENT

Boiler shall be designed to burn propane. Each boiler shall comply with Federal, state, and local emission regulations.

2.2.1 Burners

2.2.1.1 Gas and Combination Gas-Oil Fired Burners and Controls

Burners shall be UL approved mechanical draft burners with all air necessary for combustion supplied by a blower where the operation is coordinated with the burner. Burner shall be provided complete with fuel supply system in conformance with all applicable safety codes or standards

2.2.2 Draft Fans

Fans conforming to AMCA 801 forced-draft shall be furnished as an integral part of boiler design. Fans shall be centrifugal with backward-curved blades or axial flow type. Each fan shall be sized for output volume and static pressure rating sufficient for pressure losses, excess air requirements at the burner, leakages, temperature, and elevation corrections for worst ambient conditions, all at full combustion to meet net-rated output at normal firing conditions, plus an overall excess air volume of 10 percent against a 20 percent static overpressure. Noise levels for fans shall not exceed 85 decibels in any octave band at a 3 foot station. Forced draft fan bearings shall be air cooled.

2.2.2.1 Draft Fan Control

Forced-draft centrifugal fans shall have inlet vane controls, or inlet vanes shall be suitable for use with combustion control equipment.

2.2.3 Ductwork

Air ducts connecting the forced-draft fan units with the plenum chamber shall be designed to convey air with a minimum of pressure loss due to friction. Ductwork shall be galvanized sheet metal conforming to ASTM A 653. Ducts shall be straight and smooth on the inside with laps made in direction of air flow. Ducts shall have cross-break with enough center height to assure rigidity in the duct section, shall be angle iron braced, and shall be completely free of vibration. Access and inspection doors shall be provided as indicated and required, with a minimum of one in each section between dampers or items of equipment. Ducts shall be constructed with long radius elbows having a centerline radius 1-1/2 times the duct width, or where the space does not permit the use of long radius elbows, short radius or square elbows with factory-fabricated turning vanes may be used. Duct joints shall be substantially airtight and shall have adequate strength for the service, with 1-1/2 by 1-1/2 by 1/8 inch angles used where required for strength or rigidity. Duct wall thickness shall be 16 gauge (0.0598 inch) for ducts 60 inches or less and 12 gauge (0.1046 inch) for ducts larger than 60 inches in maximum dimension. Additional ductwork shall be in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

2.3 COMBUSTION CONTROL EQUIPMENT

Combustion control equipment shall be provided as a system by a single manufacturer. Field installed automatic combustion control system shall be installed in accordance with the manufacturer's recommendations and under the direct supervision of a representative of the control manufacturer. The boiler water temperature shall be controlled by a water temperature controller. The equipment shall operate either electrically or pneumatically.

2.3.1 Electrical controls

Electrical control devices shall be rated at 24 volts and shall be connected as specified in Section 16415 ELECTRICAL WORK, INTERIOR.

2.3.2 Water Temperature Controller

The controller shall be of sturdy construction and shall be protected against dust and dampness. The thermostatic element shall be inserted in a separable socket installed in the upper part of the boiler near the water outlet. Modulating controllers shall control the fuel burning equipment to maintain set boiler water temperature within 2 percent. Controller shall be furnished with necessary equipment to automatically adjust the setting to suit the outside weather conditions. The outside air reset controller shall be operated in such a manner that the operating temperatures required by the boiler manufacturer are not compromised.

2.3.3 Boiler Combustion Controls and Positioners

- a. Gas fired boiler units shall be provided with modulating combustion controls with gas pilot or spark ignition. Modulating controls shall be provided with a means for manually controlling the firing

rate.

- b. Modulating control function shall be accomplished by using positioning type controls. Air flow ratio and fuel control valve shall be controlled by relative positions of operative levers on a jackshaft responding to a water temperature controller. Positioning type combustion control equipment shall include draft controls with synchronized fuel feed and combustion air supply controls, while and shall maintain the proper air/fuel ratio. The desired furnace draft shall be maintained within 0.01 inch of water column.

2.3.4 Combustion Safety Controls and Equipment

Combustion safety controls and equipment shall be UL listed, microprocessor-based distributed process controller. The system shall include mounting hardware, wiring and cables, and associated equipment. The controller shall be mounted completely wired, programmed, debugged, and tested to perform all of its functions. The controller shall process the signals for complete control and monitoring of the boiler. This shall include maintaining boiler status, starting and stopping all control functions, sequencing control functions and signaling alarm conditions. The program shall be documented and include cross references in description of coils and contacts. Microprocessor shall be able to perform self diagnostics and contain a message center to provide operator with status and failure mode information. Controllers for each boiler shall be mounted on a separate, free standing panel adjacent to the boiler or for packaged boilers on the boiler supporting structure. Control systems and safety devices for automatically fired boilers shall conform to ASME CSD-1. Electrical combustion and safety controls shall be rated at 120 volts, single phase, 60 Hz and shall be connected as specified in Section 16415 ELECTRICAL WORK, INTERIOR. A 4 inch diameter alarm bell shall be provided and shall be located where indicated or directed. The alarm bell shall ring when the boiler is shut down by any safety control or interlock. Indicating lights shall be provided on the control panel. A red light shall indicate flame failure, and a green light shall indicate that the main fuel valve is open. The following shutdown conditions shall require a manual reset before the boiler can automatically recycle:

- a. Flame failure.
- b. Failure to establish pilot flame.
- c. Failure to establish main flame.
- d. Low-water cutoff.
- e. High temperature cutoff.

2.3.4.1 Low-water Cutoff

Low-water cutoff shall be provided to stop the burner and draft fan when the water level drops below a predetermined point. The cutoff shall consist of a float chamber with float, float switch, and drain valve. The float switch shall be mounted on the float chamber with a packless-type leakproof connection. The float mechanism and drain valve shall be

constructed of a corrosion-resistant material. The low-water cutoff shall be UL-06 listed and shall be furnished with approved fittings and installed according to ASME boiler code requirements.

2.3.4.2 Water Flow Interlock

Hot water boiler limit controls shall be provided to include protection for low boiler water flow and high boiler water temperature. The limit controls shall be interlocked with the combustion control system to effect boiler alarm and shutdown. The controls shall not allow boiler startup unless hot water flow is proven.

2.4 PUMPS

2.4.1 Hot Water

Circulating pumps for hot water shall be electrically driven single-stage centrifugal type and have a capacity not less than indicated. Hot water circulating pumps shall be supported on a concrete foundation with a cast iron or structural steel base and shall have a closed-coupled shaft. The pump shaft shall be constructed of corrosion-resistant alloy steel, sleeve bearings and glands of bronze designed to accommodate a mechanical seal, and the housing of close-grained cast iron. Pump seals shall be capable of withstanding 240 degrees F temperature without external cooling. The motor shall have sufficient power for the service required, shall be of a type approved by the manufacturer of the pump, shall be suitable for the available electric service, and shall conform to the requirements of paragraph ELECTRICAL EQUIPMENT. Each pump suction and discharge connection shall be provided with a pressure gauge as specified. The hot water circulating pump discharge heater shall be provided with a pressure switch. Different pressure switch unit shall be a self-contained snap action type to indicate fluid pressure. Switch shall be a SPDT with 120-volt, 15-ampere rating.

2.5 AIR HANDLING UNITS

Air handling units and associated equipment shall be in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

2.6 FITTINGS AND ACCESSORIES

Boiler fittings and accessories shall be installed with each boiler in accordance with ASME BPV IV, unless otherwise specified.

2.6.1 Conventional Breeching and Stacks

2.6.1.1 Breeching

Each boiler shall be connected to the stack or flue by breeching constructed of black steel sheets not less than 0.0478 inch thick nor less than thickness of stack, whichever is larger. The clear distance between any portion of the breeching surface and any combustible material shall not be less than that specified in NFPA 211. Joints and seams shall be securely fastened and made airtight. Suitable hinged and gasketed cleanouts shall be provided, which will permit cleaning the entire smoke connection without dismantling. Flexible-type expansion joints shall be

provided as required and shall not require packing.

2.6.1.2 Stacks

Individual stub stacks shall extend above the roof to the heights indicated. Individual stub stacks shall be 20 feet in height when assembled on the boiler and measured from the ground line. Stack section shall be sheet steel having a thickness of not less than 0.0972 inch. [Prefabricated double wall stacks system shall extend above the roof to the height indicated. The stacks shall be 20 feet in height when assembled on the boiler and measured from the ground line. The inner stack shall be having a thickness of not less than 0.035 inch. The outer stack shall be sheet steel having a thickness of not less than 0.025 inch. A method of maintaining concentricity between the inner and outer stacks shall be incorporated. The joints between the stack sections shall be sealed to prevent flue gas leakage. A 0.3125 inch diameter hole shall be provided in the stack not greater than 6 inches from the furnace flue outlet for sampling of the exit gases. A method shall be provided to seal the hole to prevent exhaust gases from entering the boiler room when samples are not being taken. Each stack shall be provided complete with rain hood.

2.6.2 Expansion Tank

The hot water pressurization system shall include a diaphragm-type expansion tank which will accommodate the expanded water of the system generated within the normal operating temperature range, limiting the pressure increase at all components in the system to the maximum allowable pressure at those components. The only air in the system shall be the permanent sealed-in air cushion contained in the diaphragm-type tank. The sizes shall be as indicated. The expansion tank shall be welded steel, constructed, tested, and stamped in accordance with ASME BPV VIII Div 1 for a working pressure of 125 psi and precharged to the minimum operating pressure. The tank's air chamber shall be fitted with an air charging valve and pressure gauge. The tank shall be supported by steel legs or bases for vertical installation or steel saddles for horizontal installations. The tank shall have lifting rings and a drain connection. All components shall be suitable for a maximum operating temperature of 250 degrees F.

2.6.3 Steel Sheets

2.6.3.1 Galvanized Steel

Galvanized steel shall be ASTM A 653.

2.6.3.2 Uncoated Steel

Uncoated steel shall be ASTM A 366, composition, condition, and finish best suited to the intended use. Gauge numbers specified refer to manufacturer's standard gauge.

2.6.4 Gaskets

Gaskets shall be nonasbestos material in accordance with ASME B16.21, full face or self-centering type. The gaskets shall be of the spiral wound type with graphite filler material.

2.6.5 Steel Pipe and Fittings

2.6.5.1 Steel Pipe

Steel pipe shall be ASTM A 53, Type E or S, Grade A or B, black steel, standard weight.

2.6.5.2 Steel Pipe Fittings

Fittings shall have the manufacturer's trademark affixed in accordance with MSS SP-25 so as to permanently identify the manufacturer.

2.6.5.3 Steel Flanges

Flanged fittings including flanges, bolts, nuts, bolt patterns, etc. shall be in accordance with ASME B16.5 class 150 and shall have the manufacturers trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105. Flanges for high temperature water systems shall be serrated or raised-face type. Blind flange material shall conform to ASTM A 516 cold service and ASTM A 515 for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193.

2.6.5.4 Welded Fittings

Welded fittings shall conform to ASTM A 234 with WPA marking. Buttwelded fittings shall conform to ASME B16.9, and socket-welded fittings shall conform to ASME B16.11.

2.6.5.5 Cast-Iron Fittings

Fittings shall be ASME B16.4, Class 125, type required to match connecting piping.

2.6.5.6 Malleable-Iron Fittings

Fittings shall be ASME B16.3, type as required to match connecting piping.

2.6.5.7 Unions

Unions shall be ASME B16.39, Class 150.

2.6.5.8 Threads

Pipe threads shall conform to ASME B1.20.1.

2.6.6 Dielectric Unions

Dielectric unions shall have metal connections on both ends. The ends shall be threaded, flanged, or brazed to match adjacent piping. Metal parts of the union shall be separated so that the electrical current is below 1 percent of the galvanic current which would exist upon metal-to-metal contact.

2.6.7 Flexible Pipe Connectors

Flexible pipe connectors shall be designed for 125 psi or 150 psi service. Connectors shall be installed where indicated. The flexible

section shall be constructed of rubber, tetrafluoroethylene resin, or corrosion-resisting steel, bronze, monel, or galvanized steel. Materials used and the configuration shall be suitable for the pressure, vacuum, and temperature medium. The flexible section shall be suitable for service intended and may have threaded, welded, soldered, flanged, or socket ends. Flanged assemblies shall be equipped with limit bolts to restrict maximum travel to the manufacturer's standard limits. Unless otherwise indicated, the length of the flexible connectors shall be as recommended by the manufacturer for the service intended. Internal sleeves or liners, compatible with circulating medium, shall be provided when recommended by the manufacturer. Covers to protect the bellows shall be provided where indicated.

2.6.8 Pipe Supports

Pipe supports shall conform to MSS SP-58 and MSS SP-69.

2.6.9 Pipe Expansion

2.6.9.1 Expansion Loops

Expansion loops and offsets shall provide adequate expansion of the main straight runs of the system within the stress limits specified in ASME B31.1. The loops and offsets shall be cold-sprung and installed where indicated. Pipe guides and anchors shall be provided as indicated.

2.6.10 Valves

Valves shall be Class 125 and shall be suitable for the application. Grooved ends per AWWA C606 may be used for water service only. Valves in nonboiler external piping shall meet the material, fabrication and operating requirements of ASME B31.1. The connection type of all valves shall match the same type of connection required for the piping on which installed.

2.6.10.1 Gate Valves

Gate valves 2-1/2 inches and smaller shall conform to MSS SP-80 bronze rising stem, threaded, solder, or flanged ends. Gate valves 3 inches and larger shall conform to MSS SP-70 cast iron bronze trim, outside screw and yoke, flanged, or threaded ends.

2.6.10.2 Globe Valves

Globe valves 2-1/2 inches and smaller shall conform to MSS SP-80, bronze, threaded, soldered, or flanged ends. Globe valves 3 inches and larger shall conform to MSS SP-85, cast iron, bronze trim, flanged, or threaded ends.

2.6.10.3 Check Valves

Check valves 2-1/2 inches and smaller shall conform to MSS SP-80, bronze, threaded, soldered, or flanged ends. Check valves 3 inches and larger shall conform to MSS SP-71, cast iron, bronze trim, flanged, or threaded ends.

2.6.10.4 Angle Valves

Angle valves 2-1/2 inches and smaller shall conform to MSS SP-80 bronze, threaded, soldered, or flanged ends. Angle valves 3 inches and larger shall conform to MSS SP-85, cast iron, bronze trim, flanged, or threaded ends.

2.6.10.5 Ball Valves

Ball valves 1/2 inch and larger shall conform to MSS SP-72 or MSS SP-110, ductile iron or bronze, threaded, soldered, or flanged ends.

2.6.10.6 Plug Valves

Plug valves 2 in. and larger shall conform to MSS SP-78. Plug valves smaller than 2 in. shall conform to ASME B16.34.

2.6.10.7 Balancing Valves

Balancing valves shall have meter connections with positive shutoff valves. An integral pointer shall register the degree of valve opening. Valves shall be calibrated so that flow rate can be determined when valve opening in degrees and pressure differential across valve is known. Each balancing valve shall be constructed with internal seals to prevent leakage and shall be supplied with preformed insulation. Valves shall be suitable for 250 degrees F temperature and working pressure of the pipe in which installed. Valve bodies shall be provided with tapped openings and pipe extensions with shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings for a portable meter to measure the pressure differential. One portable differential meter shall be furnished. The meter suitable for the operating pressure specified shall be complete with hoses, vent, and shutoff valves, and carrying case. In lieu of the balancing valve with integral metering connections, a ball valve or plug valve with a separately installed orifice plate or venturi tube may be used for balancing.

2.6.10.8 Drain valves

Drain valves shall be provided at each drain point of blowdown as recommended by the boiler manufacturer. Piping shall conform to ASME BPV IV and ASTM A 53.

2.6.10.9 Safety Valves

Safety valves shall have steel bodies and shall be equipped with corrosion-resistant trim and valve seats. The valves shall be properly guided and shall be positive closing so that no leakage can occur. Adjustment of the desired back-pressure shall cover the range between 2 and 10 psig. The adjustment shall be made externally, and any shafts extending through the valve body shall be provided with adjustable stuffing boxes having renewable packing. Boiler safety valves of proper size and of the required number, in accordance with ASME BPV IV, shall be installed so that the discharge will be through piping extended to the blowoff tank to a location as indicated. Each discharge pipe for steam service shall be provided with a drip pan elbow to prevent accumulation of water on the valve. A slip joint shall be provided between drip pan elbow and riser. Each discharge pipe for hot water service shall be pitched away from the valve seat.

2.6.11 Strainers

Basket and "Y" type strainers shall be the same size as the pipelines in which they are installed. The strainer bodies shall be heavy and durable, fabricated of cast iron, and shall have bottoms drilled and tapped with a gate valve attached for blowdown purposes. Strainers shall be designed for 150 psig service and 120 degrees F. The bodies shall have arrows clearly cast on the sides indicating the direction of flow. Each strainer shall be equipped with an easily removable cover and sediment screen. The screen shall be made of 22 gauge brass sheet with small perforations numbering not less than 400 per square inch to provide a net free area through the basket of at least 3.30 times that of the entering pipe. The flow shall be into the screen and out through the perforations.

2.6.12 Pressure Gauges

Gauges shall conform to ASME B40.1 and shall be provided with throttling type needle valve or a pulsation dampener and shutoff valve. Minimum dial size shall be 3-1/2 inches. A pressure gauge shall be provided for each boiler in a visible location on the boiler.

2.6.13 Thermometers

Thermometers shall be provided with wells and separable corrosion-resistant steel sockets. Thermometers for inlet water and outlet water for each hot water boiler [and boiler] shall be provided in a visible location on the boiler. Thermometers shall have brass, malleable iron, or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a minimum 9 inch scale.

2.6.14 Air Vents

2.6.14.1 Automatic Air Vents

Automatic air vents shall be 3/4 inch quick-venting float and vacuum air valves. Each air vent valve shall have a large port permitting the expulsion of the air without developing excessive back pressure, a noncollapsible metal float which will close the valve and prevent the loss of water from the system, an air seal that will effectively close and prevent the re-entry of air into the system when subatmospheric pressures prevail therein, and a thermostatic member that will close the port against the passage of steam from the system. The name of the manufacturer shall be clearly stamped on the outside of each valve. The air vent valve shall be suitable for the pressure rating of the piping system.

2.7 ELECTRICAL EQUIPMENT

Electric motor-driven equipment shall be provided complete with motors, motor starters, and necessary control devices. Electrical equipment, motor control devices, motor efficiencies and wiring shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR. Motors which are not an integral part of a packaged boiler shall be rated for high efficiency service. Motors which are an integral part of the packaged boiler shall be the highest efficiency available by the manufacturer of the packaged boiler. Motor starters shall be provided complete with properly sized thermal overload protections and other appurtenances necessary for the motor

control specified. Starters shall be furnished in general purpose enclosures. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices but not shown shall be provided.

2.7.1 Motor Ratings

Motors shall be suitable for the voltage and frequency provided. Motors 1/2 hp and larger shall be three-phase, unless otherwise indicated. Motors shall be of sufficient capacity to drive the equipment at the specified capacity without exceeding the nameplate rating on the motor.

2.7.2 Motor Controls

Motor controllers shall be provided complete with properly sized thermal overload protection. Manual or automatic control and protective or signal devices required for the operation specified and any wiring required to such devices shall be provided.

2.8 INSULATION

Shop and field-applied insulation shall be as specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.9 TOOLS

Special tools shall be furnished. Special tools shall include uncommon tools necessary for the operation and maintenance of boilers, burners, pumps, fans, controls, meters, special piping systems, and other equipment. Small hand tools shall be furnished within a suitable cabinet, mounted where directed.

2.9.1 Breeching Cleaner

A cleaner shall be provided to clean the breeching. The cleaner shall have a jointed handle of sufficient length to clean the breeching without dismantling.

2.9.2 Tube Cleaner

If a watertube boiler is being furnished, a water-driven tube cleaner with three rotary cutters and rotary wire brush complete with the necessary length of armored water hose, valves, and other appurtenances necessary for operation shall be provided. Tube cleaner and rotary brush shall be provided for each size of water tube in the boiler, with one extra set of cutters for each size cleaner. Necessary valves and fittings shall be provided to permit ready connection of the cleaner hose to a high-pressure pump for cold water supply to operate the cleaner.

2.9.3 Tube Brush

If a firetube boiler is being furnished, a tube brush, with steel bristles and jointed handle of sufficient length to clean full length of firetubes, shall be provided.

2.9.4 Wrenches

Wrenches shall be provided as required for specialty fittings such as manholes, handholes, and cleanouts. One set of extra gaskets shall be provided for all manholes and handholes, for pump barrels, and other similar items of equipment. Gaskets shall be packaged and properly identified.

PART 3 EXECUTION

3.1 ERECTION OF BOILER AND AUXILIARY EQUIPMENT

Boiler and auxiliary equipment shall be installed in accordance with manufacturer's written instructions. Proper provision shall be made for expansion and contraction between boiler foundation and floor. This joint shall be packed with suitable nonasbestos rope and filled with suitable compound that will not become soft at a temperature of 100 degrees F. Boilers and firing equipment shall be supported from the foundations by structural steel completely independent of all brickwork. Boiler supports shall permit free expansion and contraction of each portion of the boiler without placing undue stress on any part of the boiler or setting. Boiler breeching shall be as indicated with full provision for expansion and contraction between all interconnected components.

3.2 PIPING INSTALLATION

Unless otherwise specified, nonboiler external pipe and fittings shall conform to the requirements of ASME B31.1. Pipe installed shall be cut accurately to suit field conditions, shall be installed without springing or forcing, and shall properly clear windows, doors, and other openings. Cutting or other weakening of the building structure to facilitate piping installation will not be permitted. Pipes shall be free of burrs, oil, grease and other foreign material and shall be installed to permit free expansion and contraction without damaging the building structure, pipe, pipe joints, or pipe supports. Changes in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted provided a pipe bender is used and wide sweep bends are formed. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be accepted. Vent pipes shall be carried through the roof as directed and shall be properly flashed. Unless otherwise indicated, horizontal supply mains shall pitch down in the direction of flow with a grade of not less than 1 inch in 40 feet. Open ends of pipelines and equipment shall be properly capped or plugged during installation to keep dirt or other foreign materials out of the systems. Pipe not otherwise specified shall be uncoated. Unless otherwise specified or shown, final connections to equipment shall be made with malleable-iron unions for steel pipe 2-1/2 inches or less in diameter and with flanges for pipe 3 inches or more in diameter. Unions for copper pipe or tubing shall be brass or bronze. Reducing fittings shall be used for changes in pipe sizes. In horizontal hot water lines, reducing fittings shall be eccentric type to maintain the top of the lines at the same level to prevent air binding.

3.2.1 Cold Water Connections

Cold water fill connections shall be made to the water supply system as indicated. Necessary pipe, fittings, and valves required for water connections between the boiler and cold water main shall be provided as shown. The pressure regulating valve shall be of a type that will not

stick or allow pressure to build up on the low side. The valve shall be set to maintain a terminal pressure of approximately 5 psi in excess of the static head on the system and shall operate within a 2 psi tolerance regardless of cold water supply piping pressure and without objectionable noise under any condition of operation.

3.2.2 Hot Water Piping and Fittings

Pipe shall be black steel or copper tubing. Fittings for steel piping shall be black malleable iron or cast iron to suit piping. Fittings adjacent to valves shall suit valve material. Grooved mechanical fittings will not be allowed for water temperatures above 230 degrees F.

3.2.3 Vent Piping and Fittings

Vent piping shall be black steel. Fittings shall be black malleable iron or cast iron to suit piping.

3.2.4 Gauge Piping

Piping shall be copper tubing.

3.2.5 Joints

Joints between sections of steel pipe and between steel pipe and fittings shall be threaded, grooved, flanged or welded as indicated or specified. Except as otherwise specified, fittings 1 inch and smaller shall be threaded; fittings 1-1/4 inches and up to but not including 3 inches shall be either threaded, grooved, or welded; and fittings 3 inches and larger shall be either flanged or welded. Pipe and fittings 1-1/4 inches and larger installed in inaccessible conduit or trenches beneath concrete floor slabs shall be welded. Connections to equipment shall be made with black malleable-iron unions for pipe 2-1/2 inches or smaller in diameter and with flanges for pipe 3 inches or larger in diameter. Joints between sections of copper tubing or pipe shall be flared, soldered, or brazed.

3.2.5.1 Threaded Joints

Threaded joints shall be made with tapered threads properly cut and shall be made perfectly tight with a stiff mixture of graphite and oil or with polytetrafluoroethylene tape applied to the male threads only and in no case to the fittings.

3.2.5.2 Welded Joints

Welded joints shall be in accordance with paragraph GENERAL REQUIREMENTS unless otherwise specified. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connections may be made with either welding tees or forged branch outlet fittings, either being acceptable without size limitation. Branch outlet fittings, where used, shall be forged, flared for improved flow characteristics where attached to the run, reinforced against external strains, and designed to withstand full pipe bursting strength. Socket weld joints shall be assembled so that the space between the end of the pipe and the bottom of the socket is no less than 1/16 inch and no more

than 1/8 inch.

3.2.6 Flanges and Unions

Flanges shall be faced true, provided with 1/16 inch thick gaskets, and made square and tight. Where steel flanges mate with cast-iron flanged fittings, valves, or equipment, they shall be provided with flat faces and full face gaskets. Union or flange joints shall be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items. Dielectric pipe unions shall be provided between ferrous and nonferrous piping to prevent galvanic corrosion. The dielectric unions shall have metal connections on both ends. The ends shall be threaded, flanged, or brazed to match adjacent piping. The metal parts of the union shall be separated so that the electrical current is below 1 percent of the galvanic current which would exist upon metal-to-metal contact. Gaskets, flanges, and unions shall be installed in accordance with manufacturer's recommendations.

3.2.7 Branch Connections

3.2.7.1 Branch Connections for Hot Water Systems

Branches from the main shall pitch up or down as shown to prevent air entrapment. Connections shall ensure unrestricted circulation, eliminate air pockets, and permit complete drainage of the system. Branches shall pitch with a grade of not less than 1 inch in 10 feet. When indicated, special flow fittings shall be installed on the mains to bypass portions of the water through each radiator. Special flow fittings shall be standard catalog products and shall be installed as recommended by the manufacturer.

3.2.8 Supports

3.2.8.1 General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers.

3.2.8.2 Seismic Requirements for Supports and Structural Bracing

Piping and attached valves shall be supported and braced to resist seismic loads as specified in Section 13080 SEISMIC PROTECTION FOR MECHANICAL, ELECTRICAL EQUIPMENT. Structural steel required for reinforcement to properly support piping, headers, and equipment, but not shown, shall be provided in this section. Material used for supports shall be as specified in Section 05120 STRUCTURAL STEEL.

3.2.8.3 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

- a. Types 5, 12, and 26 shall not be used.
- b. Type 3 shall not be used on insulated pipe which has a vapor barrier. Type 3 may be used on insulated pipe that does not have a vapor barrier if clamped directly to the pipe, if the clamp bottom does not extend through the insulation, and if the top clamp attachment does not contact the insulation during pipe movement.
- c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for Type 18 inserts.
- d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices furnished by the manufacturer. Field fabricated C-clamp bodies or retaining devices are not acceptable.
- e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.
- f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.
- g. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves.
- h. Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 15 feet, not more than 8 feet from end of risers, and at vent terminations.
- i. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered.
 - (1) Where steel slides do not require provisions for restraint of lateral movement, an alternate guide method may be used. On piping 4 inches and larger, a Type 39 saddle may be welded to the pipe and freely rested on a steel plate. On piping under 4 inches, a Type 40 protection shield may be attached to the pipe or insulation and freely rested on a steel slide plate.
 - (2) Where there are high system temperatures and welding to piping is not desirable, the Type 35 guide shall include a pipe cradle welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.
- j. Except for Type 3, pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation.
- k. Piping in trenches shall be supported as indicated.

1. Structural steel attachments and brackets required to support piping, headers, and equipment, but not shown, shall be provided under this section. Material and installation shall be as specified under Section 05120 STRUCTURAL STEEL. Pipe hanger loads suspended from steel joist between panel points shall not exceed 50 pounds. Loads exceeding 50 pounds shall be suspended from panel points.

3.2.8.4 Multiple Pipe Runs

In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support member shall not exceed the hanger and support spacing required for any individual pipe in the multiple pipe run. The clips or clamps shall be rigidly attached to the common base member. A clearance of 1/8 inch shall be provided between the pipe insulation and the clip or clamp for piping which may be subjected to thermal expansion.

3.2.9 Anchors

Anchors shall be provided where necessary to localize expansion or to prevent undue strain on piping. Anchors shall consist of heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Anchor braces shall be installed in the most effective manner to secure the desired results, using turnbuckles where required. Supports, anchors, or stays shall not be attached where they will injure the structure or adjacent construction during installation or by the weight of expansion of the pipeline.

3.2.10 Valves

Valves shall be installed where indicated, specified, and required for functioning and servicing of the systems. Valves shall be safely accessible. Swing check valves shall be installed upright in horizontal lines and in vertical lines only when flow is in the upward direction. Gate and globe valves shall be installed with stems horizontal or above. Valves to be brazed shall be disassembled prior to brazing and all packing removed. After brazing, the valves shall be allowed to cool before reassembling.

3.2.11 Pipe Sleeves

Pipe passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. A waterproofing clamping flange shall be installed as indicated where membranes are involved. Sleeves shall not be installed in structural members except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective wall, floor, or roof. Sleeves through walls shall be cut flush with wall surface. Sleeves through floors shall be cut flush with floor surface. Sleeves through roofs shall extend above the top surface of roof at least 6 inches for proper flashing or finishing. Unless otherwise indicated, sleeves shall be sized to provide a minimum clearance of 1/4 inch between bare pipe and sleeves or between jacket over insulation and sleeves. Sleeves in waterproofing membrane floors, bearing walls, and wet areas shall be galvanized steel pipe or cast-iron pipe. Sleeves in nonbearing walls, floors, or ceilings may be galvanized steel pipe, cast-iron pipe, or galvanized sheet metal with lock-type longitudinal

seam. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over insulation and sleeve in nonfire rated walls shall be sealed as indicated and specified in Section 07920 JOINT SEALING. Metal jackets shall be provided over insulation passing through exterior walls, firewalls, fire partitions, floors, or roofs.

Metal jackets shall not be thinner than 0.006 inch thick aluminum, if corrugated, and 0.016 inch thick aluminum, if smooth.

Metal jackets shall be secured with aluminum or stainless steel bands not less than 3/8 inch wide and not more than 8 inches apart. When penetrating roofs and before fitting the metal jacket into place, a 1/2 inch wide strip of sealant shall be run vertically along the inside of the longitudinal joint of the metal jacket from a point below the backup material to a minimum height of 36 inches above the roof. If the pipe turns from vertical to horizontal, the sealant strip shall be run to a point just beyond the first elbow. When penetrating waterproofing membrane for floors, the metal jacket shall extend from a point below the back-up material to a minimum distance of 2 inches above the flashing. For other areas, the metal jacket shall extend from a point below the backup material to a point 12 inches above material to a minimum distance of 2 inches above the flashing. For other areas, the metal jacket shall extend from a point below the backup material to a point 12 inches above the floor; when passing through walls above grade, the jacket shall extend at least 4 inches beyond each side of the wall.

3.2.11.1 Optional Counterflashing

As alternates to caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may consist of standard roof coupling for threaded pipe up to 6 inches in diameter, lead flashing sleeve for dry vents with the sleeve turned down into the pipe to form a waterproof joint, or a tack-welded or banded-metal rain shield around the pipe, sealed as indicated.

3.2.11.2 Fire Seal

Where pipes pass through firewalls, fire partitions, or floors, a fire seal shall be provided as specified in Section 07270 FIRESTOPPING.

3.2.12 Balancing Valves

Balancing valves shall be installed as indicated.

3.2.13 Thermometer Wells

A thermometer well shall be provided in each return line for each circuit in multicircuit systems.

3.2.14 Air Vents

Air vents shall be installed where shown or directed. Air vents shall be installed in piping at all system high points. The vent shall remain open until water rises in the tank or pipe to a predetermined level at which time it shall close tight. An overflow pipe from the vent shall be run to a point designated by the Contracting Officer's representative. The inlet

to the air vent shall have a gate valve or ball valve.

3.2.15 Escutcheons

Escutcheons shall be provided at all finished surfaces where exposed piping, bare or insulated, passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be chromium-plated iron or chromium-plated brass, either one-piece or split pattern, held in place by internal spring tension or setscrews.

3.2.16 Drains

A drain connection with a 1 inch gate valve or 3/4 inch hose bib shall be installed at the lowest point in the return main near the boiler. In addition, threaded drain connections with threaded cap or plug shall be installed on the heat exchanger coil on each unit heater or unit ventilator and wherever required for thorough draining of the system.

3.3 GAS FUEL SYSTEM

Gas piping, fittings, valves, regulators, tests, cleaning, and adjustments shall be in accordance with the Section 15488 GAS PIPING SYSTEMS. NFPA 58 shall be complied with unless otherwise specified. Burners, pilots, and all accessories shall be listed in UL-06. The fuel system shall be provided with a gas tight, manually operated, UL listed stop valve at the gas-supply connections, a gas strainer, a pressure regulator, pressure gauges, a burner-control valve, a safety shutoff valve suitable for size of burner and sequence of operation, and other components required for safe, efficient, and reliable operation as specified. Approved permanent and ready facilities to permit periodic valve leakage tests on the safety shutoff valve or valves shall be provided.

3.4 FIELD PAINTING

Ferrous metal not specified to be coated at the factory shall be cleaned, prepared, and painted as specified in Section 09900 PAINTING, GENERAL. Exposed pipe covering shall be painted as specified in Section 09900 PAINTING, GENERAL. Aluminum sheath over insulation shall not be painted.

3.5 HEATING SYSTEM TESTS

Before any covering is installed on pipe or heating equipment, the entire heating system's piping, fittings, and terminal heating units shall be hydrostatically tested and proved tight at a pressure of 1-1/2 times the design working pressure. Before pressurizing system for test, items or equipment (e.g., vessels, pumps, instruments, controls, relief valves) rated for pressures below the test pressure shall be blanked off or replaced with spool pieces. Before balancing and final operating test, test blanks and spool pieces shall be removed; and protected instruments and equipment shall be reconnected. With equipment items protected, the system shall be pressurized to test pressure. Pressure shall be held for a period of time sufficient to inspect all welds, joints, and connections for leaks, but not less than 2 hours. No loss of pressure will be allowed. Leaks shall be repaired and repaired joints shall be retested. Caulking of joints shall not be permitted. System shall be drained and after instruments and equipment are reconnected, the system shall be refilled

with service medium and maximum operating pressure applied. The pressure shall be held while inspecting these joints and connections for leaks. The leaks shall be repaired and the repaired joints retested. Upon completion of hydrostatic tests and before acceptance of the installation, the Contractor shall balance the heating system in accordance with Section 15990

TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS; and operating tests required to demonstrate satisfactory functional and operational efficiency shall be performed. The operating test shall cover a period of at least 24 hours for each system, and shall include, as a minimum, the following specific information in a report, together with conclusions as to the adequacy of the system:

- a. Certification of balancing.
- b. Time, date, and duration of test.
- c. Outside and inside dry bulb temperatures.
- d. Temperature of hot water supply leaving boiler.
- e. Temperature of heating return water from system at boiler inlet.
- f. Boiler make, type, serial number, design pressure, and rated capacity.
- g. Fuel burner make, model, and rated capacity; ammeter and voltmeter readings for burner motor.
- h. Circulating pump make, model, and rated capacity, and ammeter and voltmeter readings for pump motor during operation.
- i. Flue-gas temperature at boiler outlet.
- j. Percent carbon dioxide in flue-gas.
- k. Grade or type and calorific value of fuel.
- l. Draft at boiler flue-gas exit.
- m. Draft or pressure in furnace.
- n. Quantity of water circulated.
- o. Quantity of fuel consumed.
- p. Stack emission pollutants concentration.

Indicating instruments shall be read at half-hour intervals unless otherwise directed. The Contractor shall furnish all instruments, equipment, and personnel required for the tests and balancing. Fuels, water, and electricity shall be obtained as specified in the SPECIAL CONTRACT REQUIREMENTS.

3.6 CLEANING

3.6.1 Boilers and Piping

After the hydrostatic tests have been made and before the system is balanced and operating tests are performed, the boilers and feed water piping shall be thoroughly cleaned by filling the system with a solution consisting of either 1 pound of caustic soda or 1 pound of trisodium phosphate per 50 gallons of water. The proper safety precautions shall be observed in the handling and use of these chemicals. The water shall be heated to approximately 150 degrees F and the solution circulated in the system for a period of 48 hours. The system shall then be drained and thoroughly flushed out with fresh water. Strainers and valves shall be thoroughly cleaned. Prior to operating tests, air shall be removed from all water systems by operating the air vents.

3.6.2 Heating Units

Inside space heating equipment, ducts, plenums, and casing shall be thoroughly cleaned of debris and blown free of small particles of rubbish and dust and then vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided for fans that are operated during construction, and new filters shall be installed after construction dirt has been removed from the building, and the ducts, plenum, casings, and other items specified have been vacuum cleaned. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.7 Gas System Test

The gas fuel system shall be tested in accordance with the test procedures outlined in NFPA 58.

3.8 FIELD TRAINING

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 4 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The field instructions shall cover all of the items contained in the operating and maintenance instructions, as well as demonstrations of routine maintenance operations and boiler safety devices. The Contracting Officer shall be notified at least 14 days prior to date of proposed conduction of the training course.

-- End of Section --

SECTION 15653
AIR-CONDITIONING SYSTEM (UNITARY TYPE)
07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 210/240	(1989) Unitary Air-Conditioning and Air-Source Heat Pump Equipment
ARI 270	(1984) Sound Rating of Outdoor Unitary Equipment
ARI 310	(1990) Packaged Terminal Air-Conditioners
ARI 320	(1986) Water-Source Heat Pumps
ARI 325	(1985) Ground Water-Source Heat Pumps
ARI 340	(1986) Commercial and Industrial Unitary Heat Pump Equipment
ARI 350	(1986) Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment
ARI 360	(1986) Commercial and Industrial Unitary Air-Conditioning Equipment
ARI 370	(1986) Sound Rating of Large Outdoor Refrigerating and Air-Conditioning Equipment
ARI 380	(1990) Packaged Terminal Heat Pumps
ARI 410	(1991) Forced-Circulation Air-Cooling and Air-Heating Coils
ARI 460	(1987) Remote Mechanical-Draft Air-Cooled Refrigerant Condensers
ARI 490	(1989) Remote Mechanical-Draft Evaporative Refrigerant Condensers
ARI 495	(1985) Refrigerant Liquid Receivers
ARI 710	(1986) Liquid-Line Driers
ARI 720	(1988) Refrigerant Access Valves and Hose

Connectors

ARI 750 (1987) Thermostatic Refrigerant Expansion Valves

ARI 760 (1987) Solenoid Valves for Use with Volatile Refrigerants

AIR DIFFUSION COUNCIL (ADC)

ADC 1062:GRD (1984) Test Codes for Grilles, Registers and Diffusers

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 500 (1989) Test Methods for Louvers, Dampers and Shutters

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A13.1 (1981; R 1993) Scheme for the Identification of Piping Systems

ANSI S1.13 (1971; R 1986) Methods for the Measurement of Sound Pressure Levels

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47 (1990) Ferritic Malleable Iron Castings

ASTM A 48 (1993a) Gray Iron Castings

ASTM A 53 (1993) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

ASTM A 106 (1993) Seamless Carbon Steel Pipe for High-Temperature Service

ASTM A 123 (1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153 (1982; R 1987) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 181 (1993a) Forgings, Carbon Steel, for General-Purpose Piping

ASTM A 183 (1983; R 1990) Carbon Steel Track Bolts and Nuts

ASTM A 193 (1993a) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

ASTM A 234 (1992a) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

ASTM A 307	(1993a) Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength
ASTM A 334	(1991) Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service
ASTM A 525	(1993) General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM A 733	(1989) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B 32	(1993) Solder Metal
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 75	(1993) Seamless Copper Tube
ASTM B 88	(1993a) Seamless Copper Water Tube
ASTM B 117	(1990) Salt Spray (Fog) Testing
ASTM B 280	(1993a) Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM B 650	(1993) Electrodeposited Engineering Chromium Coatings of Ferrous Substrates
ASTM C 67	(1993a) Sampling and Testing Brick and Structural Clay Tile
ASTM C 534	(1988) Preformed Flexible Elastomeric Cellular thermal Insulation in Sheet and tubular Form
ASTM C 1071	(1991) Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)
ASTM D 596	(1991) Reporting Results of Analysis of Water
ASTM D 1384	(1987) Corrosion Test for Engine Coolants in Glassware
ASTM D 1784	(1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2000	(1990) Rubber Products in Automotive Applications
ASTM E 84	(1991a) Surface Burning Characteristics of

Building Materials

ASTM E 437	(1992) Industrial Wire Cloth and Screens (Square Opening Series)
ASTM F 104	(1993) Nonmetallic Gasket Materials
ASTM F 872	(1984; R 1990) Filter Units, Air Conditioning: Viscous-Impingement Type, Cleanable

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 15	(1992) Safety Code for Mechanical Refrigeration
ASHRAE 52.1	(1992) Gravimetric and Duct-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter
ASHRAE 64	(1989) Methods of Testing Remote Mechanical-Draft Evaporative Refrigerant Condensers
ASHRAE 127	(1988) Method of Testing for Rating Computer and Data Processing Room Unitary Air-Conditioners

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.5	(1988; Errata; B16.5a) Pipe Flanges and Flanged Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1991) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1989) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.39	(1986) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300

ASME B31.1	(1992; B31.1a; B31.1b) Power Piping
ASME B31.5	(1992; B31.5a) Refrigeration Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPV VIII Div 1	(1992; Addenda Dec 1992, Dec 1993)Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME BPV IX	(1992; Addenda Dec 1992, Dec 1993)Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C606	(1987) Grooved and Shouldered Joints
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AMERICAN WELDING SOCIETY (AWS)

AWS BRH	(1991) Brazing Handbook
AWS D1.1	(1994) Structural Welding Code - Steel

ASSOCIATION OF HOME APPLIANCE MANUFACTURERS (AHAM)

AHAM-01	(1994) Directory of Certified Room Air Conditioners
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CALIFORNIA REDWOOD ASSOCIATION (CRA)

CRA-01	(1992) Standard Specifications for Grades of California Redwood Lumber
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COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-50502	(Basic) Air Conditioner, (Unitary Heat Pump), Air to Air (3,000 to 300,000 BTU)
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COOLING TOWER INSTITUTE (CTI)

CTI STD-103	(1986) Standard Specifications for the Design of Cooling Towers with Redwood Lumber
CTI STD-111	(1986) Gear Speed Reducers
CTI STD-114	(1986) Specifications for the Design of Cooling Towers with Douglas Fir Lumber
CTI STD-134	(1985) Plywood for Use in Cooling Towers
CTI STD-137	(1988) Fiberglass Pultruded Structural Products for Use in Cooling Towers
CTI WMS-112	(1986) Pressure Preservative Treatment of Lumber for Industrial Water-Cooling Towers

FEDERAL SPECIFICATIONS (FS)

FS BB-F-1421	(Rev B) Fluorocarbon Refrigerants
FS F-C-2791	(Basic) Cooling Towers, Liquid (Inch-Pound)
FS QQ-B-654	(Rev A; Am 1; Notice 1) Brazing Alloys, Silver
FS WW-V-35	(Rev C) Valve, Ball

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND
FITTINGS INDUSTRY (MSS)

MSS SP-25	(1993) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-67	(1990) Butterfly Valves
MSS SP-69	(1991) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1990) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1990) Cast Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-78	(1987; R 1992) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(1987) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(1994) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends

MILITARY SPECIFICATIONS (MS)

MS MIL-A-3316	(Rev C; Am 2) Adhesives, Fire-Resistant, Thermal Insulation
MS MIL-E-17813	(Rev F) Expansion Joints, Pipe, Metallic Bellows
MS MIL-E-17814	(Rev F) Expansion Joints, Pipe, Slip-Type Packed
MS MIL-F-18113	(Rev E) Feeders, Boiler Water Treatment, By-Pass and Compound Receiver Types

MS MIL-P-16077	(Rev D) Pump, Centrifugal, Water Circulating, Electric-Motor-Driven
MS MIL-P-17552	(Rev F) Pump Units, Centrifugal, Water, Horizontal; General Service and Boiler-Feed: Electric-Motor-or Steam-Turbine-Driven
MS MIL-P-21035	(Rev B) Paint, High Zinc Dust Content, Galvanizing Repair (Metric)
MS MIL-T-27730	(Rev A) Tape, Antisieze, Polytetrafluorethylene, with Dispenser

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 6	(1993) Enclosures for Industrial Control and Systems
NEMA MG 1	(1993) Motors and Generators
NEMA MG 2	(1989) Safety Standard for Construction and Guide for Selection, Installation, and Use of Electric Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(1992) National Fuel Gas Code
NFPA 70	(1993) National Electrical Code
NFPA 90A	(1993) Installation of Air Conditioning and Ventilating Systems
NFPA 255	(1990) Method of Test of Surface Burning Characteristics of Building Materials

NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION (NAIMA)

NAIMA-01	(1993) Fibrous Glass Duct Construction Standards
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SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL
ASSOCIATION (SMACNA)

SMACNA-05	(1992) Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems
SMACNA-06	(1985) HVAC Duct Construction Standards - Metal and Flexible
SMACNA-10	(1985) HVAC Air Duct Leakage Test Manual

UNDERWRITERS LABORATORIES (UL)

UL-01	(1994) Building Materials Directory
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UL-03	(1993; Supple) Electrical Construction Materials Directory
UL-05	(1994) Fire Resistance Directory
UL 181	(1990; Rev Nov 1990) Factory-Made Air Ducts and Air Connectors
UL 207	(1993; Rev Feb 1994) Refrigerant-Containing Components and Accessories, Nonelectrical
UL 214	(1993) Tests for Flame-Propagation of Fabrics and Films
UL 484	(1993; Rev Nov 1993) Room Air Conditioners
UL 555	(1990; Rev thru Nov 1993) Fire Dampers
UL 586	(1990) High Efficiency, Particulate, Air Filter Units
UL 900	(1987; Rev Jul 1993) Test Performance of Air Filter Units
UL 1995	(1990) Heating and Cooling Equipment

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA-01	(1991; Supple No. 3) Western Lumber Grading Rules 91
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1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

SD-01 Data

Air-Conditioning/Heat Pump System; GA

Manufacturer's standard catalog data, prior to the purchase or installation of a particular component, shall be highlighted to show brand name, model number, size, options, performance charts and curves, etc. in sufficient detail to demonstrate compliance with contract requirements. Data shall be submitted for each specified component. Data shall include manufacturer's recommended installation instructions and procedures.

Spare Parts Data; FIO

Spare parts data for each different item of equipment specified, after approval of detail drawings and not later than 1 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of the parts recommended by the manufacturer to be replaced on a routine basis.

Framed instructions for posting, at least 2 weeks prior to construction completion.

SD-07 Schedules

Tests; FIO.

A letter, at least 10 working days in advance of each tests, advising the Contracting Officer of the test. Individual letters shall be submitted for the condenser water system, refrigerant system, ductwork leak tests, cooling tower tests, condenser water quality tests, and the system performance tests. Each letter shall identify the date, time, and location for each test.

SD-09 Reports

Tests; GA

Six copies of each test containing the information described below in bound 8-1/2 by 11 inch booklets.

SD-13 Certificates

Air-Conditioning/Heat Pump System; GA

Where the system, components, or equipment are specified to comply with requirements of ARI, ASHRAE, ASME, or UL, proof of such compliance shall be provided. The label or listing of the specified agency shall be acceptable evidence. In lieu of the label or listing, a written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency may be submitted.

Service Organizations; FIO

A certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. The service organizations shall be reasonably convenient to the equipment installation and be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

Operation Manual; FIO

Six complete copies of maintenance manual in bound 8-1/2 by 11 inch booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals shall include piping and equipment layouts and simplified wiring and control diagrams of the system as installed.

1.3 DELIVERY, STORAGE, AND HANDLING

Stored items shall be protected from the weather and contamination. Proper protection and care of all material before, during, and after installation shall be the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During installation, piping and similar openings shall be capped to keep out dirt

and other foreign matter.

1.4 PROJECT/SITE CONDITIONS

1.4.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2 year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience shall be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures. Products having less than a 2 year field service record shall be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. Products shall be supported by a service organization. System components shall be environmentally suitable for the indicated locations.

2.2 NAMEPLATES

Major equipment including compressors, condensers, receivers, heat exchanges, fans, cooling towers, pumps and motors shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment. Plates shall be durable and legible throughout equipment life and made of anodized aluminum. Plates shall be fixed in prominent locations with nonferrous screws or bolts.

2.3 ELECTRICAL WORK

Electrical equipment, motors, motor efficiencies, and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electrical characteristics shall be as shown, and unless otherwise indicated, all motors of 1 horsepower and above with open, drip proof, totally enclosed, or explosion proof fan cooled enclosures, shall be high efficiency type. Field wiring shall be in accordance with manufacturer's instructions. Each motor shall conform to NEMA MG 1 and NEMA MG 2 and be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Motors shall be continuous duty with the enclosure specified. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control indicated. Motors shall be furnished with a magnetic across-the-line or reduced voltage type starter as required by the manufacturer. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered

interval between start and stop. Motors shall be sized for the applicable loads. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of enclosure. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided.

2.4 UNITARY EQUIPMENT, ROOM UNIT

2.4.1 Compressor

Compressor shall be hermetically sealed reciprocating, rotary, or scroll type. Compressor shall be fitted with permanent split capacitor motor, overload protection, and vibration isolators. Compressor shall be protected against high discharge pressure, loss of charge, low voltage, and short cycling.

2.4.2 Air-To-Refrigerant Coils

Evaporator and condenser coils shall have copper tubes of 3/8 inch minimum diameter with copper or aluminum fins that are mechanically bonded or soldered to the tubes. Coils shall be protected with a minimum 3 mil thick phenolic or vinyl coating. Casing shall be galvanized steel or aluminum. Contact of dissimilar metals shall be avoided. Coils shall be tested in accordance with ASHRAE 15 at the factory and be suitable for the working pressure of the installed system. Each coil shall be dehydrated and sealed after testing and prior to evaluation and charging. Each unit shall be provided with a factory operating charge of refrigerant and oil or a holding charge. Unit shipped with a holding charge shall be field charged. A condensate removal system shall be provided.

2.4.3 Fans

Indoor and outdoor fans shall be the centrifugal, direct driven type. Fans shall be statically and dynamically balanced. Outdoor fan shall be designed so that condensate will evaporate without drip, splash, or spray on building exterior. Indoor fan shall be provided with a minimum two-speed motor with built-in overload protection. Fan motors shall be the inherently protected, permanent split-capacitor type.

2.4.4 Air Filters

Filters shall be of the sectional or panel cleanable type and be capable of filtering the entire air supply.

2.4.5 Supplemental Heat

Supplemental heat shall be provided as specified in paragraph "System Components".

2.4.6 Cabinet Construction

Cabinet shall be free of visible fasteners, sharp protuberances and edges. Enclosure sheet metal shall be a minimum of 18 gauge steel with a protective coating. Face panels shall be removable and shall provide full

access to unit appurtenances. Access to controls shall be without removal of the face panel. Conditioned air shall discharge through adjustable louvers. Cabinet shall be thermally and acoustically insulated with materials which conform to NFPA 90A. Paint and finishes shall comply with the requirements specified in paragraph "Factory Coating".

2.4.7 Wall Sleeve

Louver shall be stormproof type, constructed of anodized, stamped or extruded aluminum. Sleeve shall be a water and airtight completely insulated assembly, with weather-resistant protective coating.

2.4.8 Unit Controls

Controls shall include an on-off switch, high and low selector switch for both the heating and cooling mode, multiple speed fan cooling and heating mode, room air fan switch, outside air damper control, and an adjustable cooling and heating thermostat. Function and temperature controls shall be integral to unit.

2.5 SYSTEM COMPONENTS

2.5.1 Refrigerant and Oil

Refrigerant shall be one of the fluorocarbon gases that is in accordance with FS BB-F-1421 and has an Ozone Depletion Potential (ODP) of less than or equal to 0.05. Contractor shall provide and install a complete charge of refrigerant for the installed system as recommended by the manufacturer. Except for factory sealed units, two complete charges of lubricating oil for each compressor crankcase shall be furnished. One charge shall be used during the system performance testing period. Following the satisfactory completion of the performance testing, the oil shall be drained and replaced with a second charge. Lubricating oil shall be of a type and grade recommended by the manufacturer for each compressor. Where color leak indicator dye is incorporated, charge shall be in accordance with manufacturer's recommendation.

2.5.2 Fans

Fan wheel shafts shall be supported by either maintenance-accessible lubricated antifriction block-type bearings, or permanently lubricated ball bearings. Unit fans shall be selected to produce the cfm required at the fan total pressure. Motor starters, if applicable, shall be magnetic across-the-line type with an open enclosure. Thermal overload protection shall be of the manual or automatic-reset type. Fan wheels or propellers shall be constructed of aluminum or galvanized steel. Centrifugal fan wheel housings shall be of galvanized steel, and both centrifugal and propeller fan casings shall be constructed of aluminum or galvanized steel. Steel elements of fans, except fan shafts, shall be hot-dipped galvanized after fabrication or fabricated of mill galvanized steel. Mill-galvanized steel surfaces and edges damaged or cut during fabrication by forming, punching, drilling, welding, or cutting shall be recoated with an approved zinc-rich compound. Fan wheels or propellers shall be statically and dynamically balanced.

2.5.3 Electric Heating Coil

Coil shall be an electric duct heater in accordance with UL 1995 and NFPA 70. Coil shall be duct- or unit-mounted. Coil shall be of the nickel chromium resistor, single stage, strip type. Coil shall be provided with a built-in or surface-mounted high-limit thermostat interlocked electrically so that the coil cannot be energized unless the fan is energized. Coil casing and support brackets shall be of galvanized steel or aluminum. Coil shall be mounted to eliminate noise from expansion and contraction and be completely accessible for service.

2.5.4 Air Filters

Air filters shall be listed in accordance with requirements of UL 900, except high efficiency particulate air filters of 99.97 percent efficiency by the DOP Test Method shall be as listed under the label service and shall meet the requirements of UL 586.

2.5.4.1 Replaceable Media Filters

Replaceable media filters shall be the dry-media type, of the size required to suit the application. Filtering media shall be not less than 2 inches thick fibrous glass media pad supported by a structural wire grid or woven wire mesh. Pad shall be enclosed in a holding frame of not less than 16 gauge galvanized steel, and equipped with quick-opening mechanism for changing filter media. The air flow capacity of the filter shall be based on net filter face velocity not exceeding 300 feet per minute, with initial resistance of 0.13 inches water gauge. Average efficiency shall be not less than 30 percent when tested in accordance with ASHRAE 52.1.

PART 3 EXECUTION

3.1 INSTALLATION

Work shall be performed in accordance with the manufacturer's published diagrams, recommendations, and equipment warranty requirements. Where equipment is specified to conform to the requirements of ASME BPV VIII Div 1 and ASME BPV IX, the design, fabrication, and installation of the system shall conform to ASME BPV VIII Div 1 and ASME BPV IX.

3.1.1 Equipment

Refrigeration equipment and the installation thereof shall conform to ASHRAE 15. Necessary supports shall be provided for all equipment, appurtenances, and pipe as required, including frames or supports for compressors, pumps, cooling towers, condensers, and similar items. Compressors shall be isolated from the building structure. If mechanical vibration isolators are not provided, vibration absorbing foundations shall be provided. Each foundation shall include isolation units consisting of machine and floor or foundation fastenings, together with intermediate isolation material. Other floor-mounted equipment shall be set on not less than a 6 inch concrete pad doweled in place. Concrete foundations for floor mounted pumps shall have a mass equivalent to three times the weight of the components, pump, base plate, and motor to be supported. In lieu of concrete pad foundation, concrete pedestal block with isolators placed between the pedestal block and the floor may be provided. Concrete pedestal block shall be of mass not less than three times the combined pump, motor, and base weights. Isolators shall be selected and sized based on load-bearing requirements and the lowest frequency of vibration to be isolated. Lines connected to pumps mounted on pedestal blocks shall be

provided with flexible connectors. Foundation drawings, bolt-setting information, and foundation bolts shall be furnished prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Concrete for foundations shall be as specified in Section 03300 CONCRETE FOR BUILDING CONSTRUCTION. Equipment shall be properly leveled, aligned, and secured in place in accordance with manufacturer's instructions.

3.1.2 Mechanical Room Ventilation

Mechanical rooms containing refrigeration components or equipment shall be ventilated to the outdoors as indicated. Refrigerant relief device vent piping which is not returned to the system shall be routed to the atmosphere as indicated. Relief piping shall be supported independently of relief device and braced against reaction forces. The ventilation system shall be in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION AND EXHAUST SYSTEM.

3.1.3 Building Surface Penetrations

Sleeves in nonload bearing surfaces shall be galvanized sheet metal, conforming to ASTM A 525, Coating Class G-90, 20 gauge. Sleeves in load bearing surfaces shall be uncoated carbon steel pipe, conforming to ASTM A 53, Schedule 30. Sealants shall be applied to moisture and oil-free surfaces and elastomers to not less than 1/2 inch depth. Sleeves shall not be installed in structural members.

3.1.3.1 Refrigerated Space

Refrigerated space building surface penetrations shall be fitted with sleeves fabricated from hand-lay-up or helically wound, fibrous glass reinforced polyester or epoxy resin with a minimum thickness equal to equivalent size Schedule 40 steel pipe. Sleeves shall be constructed with integral collar or cold side shall be fitted with a bonded slip-on flange or extended collar. In the case of masonry penetrations where sleeve is not cast-in, voids shall be filled with latex mixed mortar cast to shape of sleeve and flange/external collar type sleeve shall be assembled with butyl elastomer vapor barrier sealant through penetration to cold side surface vapor barrier overlap and fastened to surface with masonry anchors. Integral cast-in collar type sleeve shall be flashed as indicated with not less than 4 inches of cold side vapor barrier overlap of sleeve surface. Normally noninsulated penetrating round surfaces shall be sealed to sleeve bore with mechanically expandable seals in vapor tight manner and remaining warm and cold side sleeve depth shall be insulated with not less than 4 inches of foamed-in-place rigid polyurethane or foamed-in-place silicone elastomer. Vapor barrier sealant shall be applied to finish warm side insulation surface. Warm side of penetrating surface shall be insulated beyond vapor barrier sealed sleeve insulation for a distance which prevents condensation. Wires in refrigerated space surface penetrating conduit shall be sealed with vapor barrier plugs or compound to prevent moisture migration through conduit and condensation therein.

3.1.3.2 General Service Areas

Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface. Pipes passing through concrete or masonry wall or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall be of

such size as to provide a minimum of 1/4 inch all-around clearance between bare pipe and sleeves or between jacketed-insulation and sleeves. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over-insulation and sleeve shall be sealed in accordance with Section 07920 JOINT SEALING.

3.1.3.3 Waterproof Penetrations

Pipes passing through roof or floor waterproofing membrane shall be installed through a 17-ounce copper sleeve, or a 0.032 inch thick aluminum sleeve, each within an integral skirt or flange. Flashing sleeve shall be suitably formed, and skirt or flange shall extend not less than 8 inches from the pipe and be set over the roof or floor membrane in a troweled coating of bituminous cement. The flashing sleeve shall extend up the pipe a minimum of 2 inches above the roof or floor penetration. The annular space between the flashing sleeve and the bare pipe or between the flashing sleeve and the metal-jacket-covered insulation shall be sealed as indicated. Penetrations shall be sealed by either one of the following methods.

a. Waterproofing Clamping Flange: Pipes up to and including 10 inches in diameter passing through roof or floor waterproofing membrane may be installed through a cast iron sleeve with caulking recess, anchor lugs, flashing clamp device, and pressure ring with brass bolts. Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess.

b. Modular Mechanical Type Sealing Assembly: In lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve or conduit and sleeve, a modular mechanical type sealing assembly may be installed. Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion protected carbon steel bolts, nuts, and pressure plates. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe/conduit and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe/conduit and sleeve involved. The Contractor electing to use the modular mechanical type seals shall provide sleeves of the proper diameters.

3.1.3.4 Fire-Rated Penetrations

Penetration of fire-rated walls, partitions, and floors shall be sealed as specified in Section 07270 FIRESTOPPING.

3.1.3.5 Escutcheons

Finished surfaces where exposed piping, bare or insulated, pass through floors, walls, or ceilings, except in boiler, utility, or equipment rooms, shall be provided with escutcheons. Where sleeves project slightly from floors, special deep-type escutcheons shall be used. Escutcheon shall be secured to pipe or pipe covering.

3.1.4 Access Panels

Access panels shall be provided for all concealed valves vents, controls, and items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced. Access panels shall be as specified in Section 05500 MISCELLANEOUS METALS.

3.1.5 General Piping Installation

3.1.5.1 Brazed Joints

Brazing shall be performed in accordance with AWS BRH, except as modified herein. During brazing, the pipe and fittings shall be filled with a pressure regulated inert gas, such as nitrogen, to prevent the formation of scale. Before brazing copper joints, both the outside of the tube and the inside of the fitting shall be cleaned with a wire fitting brush until the entire joint surface is bright and clean. Brazing flux shall not be used. Surplus brazing material shall be removed at all joints. Steel tubing joints shall be made in accordance with the manufacturer's recommendations. Joints in steel tubing shall be painted with the same material as the baked-on coating within 8 hours after joints are made. Tubing shall be protected against oxidation during brazing by continuous purging of the inside of the piping using nitrogen. Piping shall be supported prior to brazing and not be sprung or forced.

3.1.5.2 Threaded Joints

Threaded joints shall be made with tapered threads and made tight with PTFE tape complying with MS MIL-T-27730 or equivalent thread-joint compound applied to the male threads only. Not more than three threads shall show after the joint is made.

3.1.5.3 Welded Joints

Welded joints in steel refrigerant piping shall be fusion-welded. Changes in direction of piping shall be made with welded fittings only; mitering or notching pipe or other similar construction to form elbows or tees will not be permitted. Branch connections shall be made with welding tees or forged welding branch outlets. Steel pipe shall be thoroughly cleaned of all scale and foreign matter before the piping is assembled. During welding, the pipe and fittings shall be filled with a pressure regulated inert gas, such as nitrogen, to prevent the formation of scale. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and rewelded at no additional cost to the Government. Electrodes shall be stored and dried in accordance with AWS D1.1 or as recommended by the manufacturer. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.5.4 Flanged Joints

Flanged joints shall be assembled square end tight with matched flanges, gaskets, and bolts. Gaskets shall be suitable for use with the refrigerants to be handled. When steel refrigerant piping is used, union or flange joints shall be provided in each line immediately preceding the connection to each piece of equipment requiring maintenance, such as compressors, coils, refrigeration equipment, control valves, and other

similar items.

3.1.5.5 Flared Connections

When flared connections are used, a suitable lubricant shall be used between the back of the flare and the nut in order to avoid tearing the flare while tightening the nut.

3.1.6 Condenser Water Piping

Pipe and fitting installation shall conform to the requirements of ASME B31.1. Pipe shall be cut accurately to measurements established at the jobsite, and worked into place without springing or forcing, completely clearing all windows, doors, and other openings. Cutting or other weakening of the building structure to facilitate piping installation will not be permitted without written approval. Pipe or tubing shall be cut square, shall have burrs removed by reaming, and shall permit free expansion and contraction without causing damage to the building structure, pipe, joints, or hangers.

3.1.6.1 Directional Changes

Changes in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide weep bends are formed. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be accepted.

3.1.6.2 Functional Requirements

Horizontal supply mains shall pitch down in the direction of flow as indicated. The grade shall not be less than 1 inch in 40 feet. Reducing fittings shall be used for changes in pipe sizes. Open ends of pipelines and equipment shall be capped or plugged during installation to keep dirt or other foreign materials out of the system. Pipe not otherwise specified shall be uncoated. Connections to appliances shall be made with malleable iron unions for steel pipe 2-1/2 inches or less in diameter, and with flanges for pipe 3 inches or more in diameter. Connections between ferrous and copper piping shall be electrically isolated from each other with dielectric unions or flanges. Piping located in air plenums shall conform to NFPA 90A requirements. Pipe and fittings installed in inaccessible conduits or trenches under concrete floor slabs shall be welded.

3.1.6.3 Valves

Isolation gate or ball valves shall be installed on each side of each piece of equipment, at the midpoint of all looped mains, and at any other points indicated or required for draining, isolating, or sectionalizing purpose. Isolation valves may be omitted where balancing cocks are installed to provide both balancing and isolation functions. Each valve except check valves shall be identified. Valves in horizontal lines shall be installed with stems horizontal or above.

3.1.6.4 Air Vents

Air vents shall be provided at all high points, on all water coils, and

where indicated to ensure adequate venting of the piping system.

3.1.6.5 Drains

Drains shall be provided at all low points and where indicated to ensure complete drainage of the piping. Drains shall be accessible, and shall consist of nipples and caps [or plugged tees] unless otherwise indicated.

3.1.6.6 Flexible Pipe Connectors

Preinsulated flexible pipe connectors shall be attached to other components in strict accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Hangers, when required to suspend the connectors, shall be of the type recommended by the flexible pipe connector manufacturer and shall be provided at the intervals recommended.

3.1.7 Flanges and Unions

Except where copper tubing is used, union or flanged joints shall be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items.

3.1.7.1 Grooved Mechanical Joints

Grooves shall be prepared in accordance with the coupling manufacturer's instructions. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, or narrow-land micrometer. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances.

3.1.8 Refrigeration Piping

Unless otherwise specified, pipe and fittings installation shall conform to requirements of ASME B31.5. Pipe shall be cut accurately to measurement established at the jobsite and worked into place without springing or forcing. Cutting or otherwise weakening of the building structure to facilitate piping installation will not be permitted without written approval. Pipes shall be cut square, shall have burrs removed by reaming, and shall be installed in a manner to permit free expansion and contraction without damage to joints or hangers. Filings, dust, or dirt shall be wiped from interior of pipe before connections are made.

3.1.8.1 Directional Changes

Changes in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide-sweep bends are formed. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, or other malformations will not be accepted.

3.1.8.2 Functional Requirements

Piping shall be installed 1/2 inch per 10 feet of pipe in the direction of

flow to ensure adequate oil drainage. Open ends of refrigerant lines or equipment shall be properly capped or plugged during installation to keep moisture, dirt, or other foreign material out of the system. Piping shall remain capped until installation. Equipment piping shall be in accordance with the equipment manufacturer's recommendations and the contract drawings.

3.1.8.3 Manual Valves

Stop valves shall be installed on each side of each piece of equipment such as compressors, condensers, evaporators, receivers, and other similar items in multiple-unit installation, to provide partial system isolation as required for maintenance or repair. Angle and globe valves shall be installed with stems horizontal unless otherwise indicated. Ball valves shall be installed with stems positioned to facilitate operation and maintenance. Isolating valves for pressure gauges and switches shall be external to thermal insulation. Safety switches shall not be fitted with isolation valves. Thermal wells for insertion thermometers and thermostats shall extend beyond thermal insulation surface not less than 1 inch. Filter dryers having access ports may be considered a point of isolation. Purge valves shall be provided at all points of systems where accumulated noncondensable gases would prevent proper system operation. Valves shall be furnished to match line size, unless otherwise indicated or approved.

3.1.8.4 Expansion Valves

Expansion valves shall be installed with the thermostatic expansion valve bulb located on top of the suction line when the suction line is less than 2-1/8 inches in diameter and at the 4 o'clock or 8 o'clock position on lines larger than 2-1/8 inches. The bulb shall be securely fastened with two clamps. The bulb shall be insulated. The bulb shall be installed in a horizontal portion of the suction line, if possible, with the pigtail on the bottom. If the bulb must be installed in a vertical line, the bulb tubing shall be facing up.

3.1.8.5 Valve Identification

Each system valve, including those which are part of a factory assembly, shall be tagged. Tags shall be in alphanumeric sequence, progressing in direction of fluid flow. Tags shall be embossed, engraved, or stamped plastic or nonferrous metal of various shapes, sized approximately 1-3/8 inch diameter, or equivalent dimension, substantially attached to a component or immediately adjacent thereto. Tags shall be attached with nonferrous, heavy duty, bead or link chain, 14 gauge annealed wire, nylon cable bands or as approved. Tag numbers shall be referenced in Operation and Maintenance Manuals and system diagrams.

3.1.8.6 Vibration Dampers

Vibration damper shall be provided in the suction and discharge lines on spring mounted compressors. Vibration dampers shall be installed parallel with the shaft of the compressor and be anchored firmly at the upstream end on the suction line and the downstream end in the discharge line.

3.1.8.7 Strainers

Strainers shall be provided immediately ahead of solenoid valves and expansion devices and where indicated. Strainers may be an integral part

of the expansion valve.

3.1.8.8 Filter Dryer

A liquid line filter dryer shall be provided on each refrigerant circuit located such that all liquid refrigerant passes through a filter dryer. Dryers shall be sized in accordance with the manufacturers recommendations. A dryer shall be installed such that it can be isolated from the system, the isolated portion of the system evacuated, and the filter dryer replaced. Dryers shall be installed in the horizontal position except replaceable core filter dryers may be installed in the vertical position with the access flange on the bottom.

3.1.8.9 Sight Glass

A moisture indicating sight glass shall be installed in all refrigerant circuits down stream of filter dryers and where indicated. Sight glass shall be full line size.

3.1.8.10 Flexible Connectors

Flexible metallic connectors shall be installed perpendicular to line of motion being isolated. Piping for equipment with bidirectional motion shall be fitted with two flexible connectors, in perpendicular planes. Reinforced elastomer flexible connectors shall be installed in accordance with manufacturer's instructions. Piping guides and restraints related to flexible connectors shall be provided as required.

3.1.9 Thermometers

Thermometers located within 5 feet of floor may be rigid stem type. Where thermal well is located above 5 feet above floor, thermometer shall be universal adjustable angle type or remote element type to 7 feet above floor and remote element type where thermal well is 7 feet or more above floor. Thermometers shall be located in coolant supply and return or waste lines at each heat exchanger, condenser water lines entering and leaving the condenser, at each automatic temperature control device without an integral thermometer, refrigerant liquid line leaving receiver, refrigerant suction line at each evaporator or liquid cooler, and where indicated or required for proper operation of equipment.

3.1.10 Piping Supports

Refrigerant pipe supports shall be in accordance with ASME B31.5. Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement, when operating temperatures exceed ambient temperatures, shall be supported by variable spring hangers and supports or by constant support hangers.

3.1.10.1 Seismic Requirements

Piping and attached valves shall be supported and braced to resist seismic loads as specified under Section 13080 SEISMIC PROTECTION FOR MECHANICAL, ELECTRICAL EQUIPMENT [as indicated]. Structural steel required for

reinforcement to properly support piping, headers, and equipment but not shown shall be provided under this section. Material used for support shall be as specified under Section 05210 STRUCTURAL STEEL.

3.1.10.2 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Masonry anchors for overhead applications shall be constructed of ferrous materials only. Material used for support shall be as specified under Section 05210 STRUCTURAL STEEL.

3.1.11 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein. Pipe hanger types 5, 12, and 26 shall not be used.

3.1.11.1 Hangers

Type 3 shall not be used on insulated piping. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

3.1.11.2 Inserts

Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustments may be used if they otherwise meet the requirements for Type 18 inserts.

3.1.11.3 C-Clamps

Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

3.1.11.4 Angle Attachments

Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

3.1.11.5 Saddles and Shields

Where Type 39 saddle or Type 40 shield are permitted for a particular pipe attachment application, the Type 39 saddle, connected to the pipe, shall be used on all pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 40 shields shall be used on all piping less than 4 inches and all piping 4 inches and larger carrying medium less than 60 degrees F. A high density insulation insert of cellular glass shall be used under the Type 40 shield for piping 2 inches and larger.

3.1.11.6 Horizontal Pipe Supports

Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Pipe hanger loads suspended from steel joist

with hanger loads between panel points in excess of 50 pounds shall have the excess hanger loads suspended from panel points.

3.1.11.7 Vertical Pipe Supports

Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 15 feet, not more than 8 feet from end of risers, and at vent terminations.

3.1.11.8 Pipe Guides

Type 35 guides using, steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered.

3.1.11.9 Steel Slides

Where steel slides do not require provisions for restraint of lateral movement, an alternate guide method may be used. On piping 4 inches and larger, a Type 39 saddle shall be used. On piping under 4 inches, a Type 40 protection shield may be attached to the pipe or insulation and freely rest on a steel slide plate.

3.1.11.10 High Temperature Guides with Cradles

Where there are high system temperatures and welding to piping is not desirable, then the Type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches, or by an amount adequate for the insulation, whichever is greater.

3.1.11.11 Multiple Pipe Runs

In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run.

3.1.12 Pipe Alignment Guides

Pipe alignment guides shall be provided where indicated for expansion loops, offsets, and bends and as recommended by the manufacturer for expansion joints, not to exceed 5 feet on each side of each expansion joint, and in lines 4 inches or smaller not more than 2 feet on each side of the joint.

3.1.13 Pipe Anchors

Anchors shall be provided wherever necessary or indicated to localize expansion or to prevent undue strain on piping. Anchors shall consist of heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Anchor braces shall be installed in the most effective manner to secure the desired results using turnbuckles where required. Supports, anchors, or stays shall not be attached where they will injure the structure or adjacent construction during installation

or by the weight of expansion of the pipeline. Where pipe and conduit penetrations of vapor barrier sealed surfaces occur, these items shall be anchored immediately adjacent to each penetrated surface, to provide essentially zero movement within penetration seal. Detailed drawings of pipe anchors shall be submitted for approval before installation.

3.1.14 Piping Identification

Each piping system and direction of fluid flow shall be identified in accordance with applicable provisions of ANSI A13.1 with color coded, water, moisture and broad-spectrum temperature resistant, plastic labels.

3.1.15 Metal Ductwork

Installation shall be in accordance with SMACNA-06 unless otherwise indicated. Duct supports for sheet metal ductwork shall be in accordance with SMACNA-06, unless otherwise specified. Friction beam clamps indicated in SMACNA-06 will not be used. [Risers on high velocity ducts shall be anchored in the center of the vertical run to allow ends of riser to move due to thermal expansion.] Supports on the risers shall allow free vertical movement of the duct. Supports shall be attached only to structural framing members and concrete slabs. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Where C-clamps are used, retainer clips shall be provided.

3.1.16 Fibrous Glass Ductwork

Installation shall be in accordance with the manufacturer's written recommendations unless otherwise required in NAIMA-01. Duct supports for fibrous glass ductwork shall conform to NAIMA-01. In those cases not covered in NAIMA-01, the written recommendation of the fibrous duct manufacturer shall be followed.

3.1.17 Acoustical Duct Lining

Lining shall be applied in cut-to-size pieces attached to the interior of the duct with fire-resistant adhesive conforming to NFPA 90A and MS MIL-A-3316, Class 2. Top and bottom pieces shall lap the side pieces and shall be secured with welded pins, adhered clips of metal, nylon, or high impact plastic, and speed washers or welding cup-head pins installed in accordance with SMACNA-06. Welded pins, cup-head pins, or adhered clips shall not distort the duct, burn through, nor mar the finish or the surface of the duct. Pins and washers shall be flush with the surfaces of the duct liner and all breaks and punctures of the duct liner coating shall be sealed with fire-resistant adhesive conforming to MS MIL-A-3316, Class 1. Exposed edges of the liner at the duct ends and at other joints where the lining will be subject to erosion shall be coated with a heavy brush coat of fire-resistant adhesive, conforming to MS MIL-A-3316, Class 1, to prevent delamination of glass fibers. Duct liner may be applied to flat sheet metal prior to forming duct through the sheet metal brake. Lining at the top and bottom surfaces of the duct shall be additionally secured by welded pins or adhered clips as specified for cut-to-size pieces. Other methods indicated in SMACNA-06 to obtain proper installation of duct liners in sheet metal ducts, including adhesives and fasteners, will be acceptable.

3.1.18 Field Applied Insulation

Field applied insulation shall be as specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.1.19 Factory Applied Insulation

Refrigerant suction lines between an evaporator and compressors and any cold gas inlet connections to gas cooled motors shall be insulated with not less than 3/4 inch thick unicellular plastic foam.

3.1.20 Framed Instructions

Framed instructions shall be framed under glass or laminated plastic and be posted where directed. Instructions shall include equipment layout, wiring and control diagrams, piping, valves and control sequences, and typed condensed operation instructions. The condensed operation instructions shall include preventative maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The instructions shall be posted before acceptance testing of the system.

3.2 TESTS

Tests shall be conducted in the presence of the Contracting Officer. Utilities for testing shall be provided as specified in the "SPECIAL CLAUSES". Water and electricity required for the tests will be furnished by the Government. Any material, equipment, instruments, and personnel required for the test shall be provided by the Contractor. The services of a qualified technician shall be provided as required to perform all tests and procedures indicated herein. Field tests shall be coordinated with Section 15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

3.2.1 Condenser Water System

After cleaning, water piping shall be hydrostatically tested at a pressure equal to 150 percent of the total system operating pressure for period of time sufficient to inspect every joint in the system and in no case less than 2 hours. Leaks shall be repaired and piping retested until test is successful. No loss of pressure shall be allowed. Leaks shall be repaired by rewelding or replacing pipe or fittings. Caulking of joints will not be permitted. Concealed and insulated piping shall be tested in place before concealing.

3.2.2 Refrigerant System

After all components of the refrigerant system have been installed and connected, the entire refrigeration system shall be subjected to a pneumatic test as described herein.

3.2.2.1 Preliminary Procedures

Prior to pneumatic testing, equipment which has been factory tested and refrigerant charged as well as equipment which could be damaged or cause personnel injury by imposed test pressure, positive or negative, shall be isolated from the test pressure or removed from the system. Safety relief valves and rupture discs, where not part of factory sealed systems, shall

be removed and openings capped or plugged.

3.2.2.2 Pneumatic Test

Pressure control and excess pressure protection shall be provided at the source of test pressure. Valves shall be wide open, except those leading to the atmosphere. Test gas shall be dry nitrogen, with minus 70 degree F dewpoint and less than 5 ppm oil. Test pressure shall be applied in two stages before any refrigerant pipe is insulated or covered. First stage test shall be at 10 psi with every joint being tested with a thick soap or color indicating solution. Second stage tests shall raise the system to the minimum refrigerant leakage test pressure specified in ASHRAE 15 with a maximum test pressure 25 percent greater. Pressure above 100 psig shall be raised in 10 percent increments with a pressure acclimatizing period between increments. The initial test pressure shall be recorded along with the ambient temperature to which the system is exposed. Final test pressures of the second stage shall be maintained on the system for a minimum of 24 hours. At the end of the 24 hour period, the system pressure will be recorded along with the ambient temperature to which the system is exposed. A correction factor of 0.3 psi will be allowed for each degree F change between test space initial and final ambient temperature, plus for increase and minus for a decrease. If the corrected system pressure is not exactly equal to the initial system test pressure, then the system shall be investigated for leaking joints. To repair leaks, the joint shall be taken apart, thoroughly cleaned, and reconstructed as a new joint. Joints repaired by caulking, remelting, or back-welding\brazing shall not be acceptable. Following repair, the entire system shall be retested using the pneumatic tests described above. The entire system shall be reassembled once the pneumatic tests are satisfactorily completed.

3.2.2.3 Evacuation Test

Following satisfactory completion of the pneumatic tests, the pressure shall be relieved and the entire system shall be evacuated to an absolute pressure of 300 micrometers. During evacuation of the system, the ambient temperature shall be higher than 35 degrees F. No more than one system shall be evacuated at one time by one vacuum pump. Once the desired vacuum has been reached, the vacuum line shall be closed and the system shall stand for 1 hour. If the pressure rises over 500 micrometers after the 1 hour period, then the system shall be evacuated again down to 300 micrometers and let set for another 1 hour period. The system shall not be charged until a vacuum of at least 500 micrometers is maintained for a period of 1 hour without the assistance of a vacuum line. If during the testing the pressure continues to rise, check the system for leaks, repair as required, and repeat the evacuation procedure. During evacuation, pressures shall be recorded by a thermocouple-type, electronic-type, or a calibrated-micrometer type gauge.

3.2.2.4 System Charging and Startup Test

Following satisfactory completion of the evacuation tests, the system shall be charged with the required amount of refrigerant by raising pressure to normal operating pressure and in accordance with manufacturer's procedures. Following charging, the system shall operate with high-side and low-side pressures and corresponding refrigerant temperatures, at design or improved values. The entire system shall be tested for leaks. Fluorocarbon systems shall be tested with halide torch or electronic leak detectors.

3.2.2.5 Refrigerant Leakage

If a refrigerant leak is discovered after the system has been charged, the leaking portion of the system shall immediately be isolated from the remainder of the system and the refrigerant pumped into the system receiver or other suitable container. Under no circumstances shall the refrigerant be discharged into the atmosphere.

3.2.2.6 Contractor's Responsibility

The Contractor shall, at all times during the installation and testing of the refrigeration system, take steps to prevent the release of refrigerants into the atmosphere. The steps shall include, but not be limited to, procedures which will minimize the release of refrigerants to the atmosphere and the use of refrigerant recovery devices to remove refrigerant from the system and store the refrigerant for reuse or reclaim. At no time shall more than 3 ounces of refrigerant be released to the atmosphere in any one occurrence. Any system leaks within the first year shall be repaired in accordance with the requirements herein at no cost to the Government including material, labor, and refrigerant if the leak is the result of defective equipment, material, or installation.

3.2.3 Ductwork Leak Tests

Ductwork leak test shall be performed for the entire air distribution system, including fans, coils, filters, etc., designated as static pressure Class 3 inch water gauge through Class 10 inch water gauge. Test procedure, apparatus, and report shall conform to SMACNA-10.

3.2.4 System Performance Tests

After the foregoing tests have been completed and before each refrigeration system is accepted, tests to demonstrate the general operating characteristics of all equipment shall be conducted by a registered professional engineer or an approved manufacturer's start-up representative experienced in system start-up and testing, at such times as directed. Tests shall cover a period of not less than 48 hours for each system and demonstrate that the entire system is functioning in accordance with the drawings and specifications. Corrections and adjustments shall be made as necessary and tests shall be re-conducted to demonstrate that the entire system is functioning as specified. Prior to acceptance, service valve seal caps and blanks over gauge points shall be installed and tightened. Any refrigerant lost during the system startup shall be replaced. If tests do not demonstrate satisfactory system performance, deficiencies shall be corrected and the system shall be retested.

3.3 INSPECTIONS

At the conclusion of the one year period, cooling towers and condensers shall be inspected for problems due to corrosion, scale, and biological growth. If the cooling tower and condenser are found not to conform to the manufacturers recommended conditions, assuming the water treatment company recommendations have been followed; the water treatment company shall provide all chemicals and labor for cleaning or repairing the equipment as required by the manufacturer's recommendations.

3.4 CLEANING AND ADJUSTING

3.4.1 Piping

Prior to testing, pipes shall be cleaned free of scale and thoroughly flushed of all foreign matter. A temporary bypass shall be provided for water coils to prevent flushing water from passing through coils. Strainers and valves shall be thoroughly cleaned. Prior to testing and balancing, air shall be removed from each water system through the use of the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Air vents shall be plugged or capped after the system has been vented.

3.4.2 Ductwork

Prior to testing, inside of ducts, plenums, and casing shall be thoroughly cleaned of all debris and blown free of small particles of rubbish and dust and then vacuum cleaned before installing outlet faces. Temporary filters shall be provided for fans that are operated during construction. New filters shall be installed after all construction dirt has been removed from the building and the ducts, plenum, casings, and other items specified have been vacuum cleaned. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.4.3 Equipment

Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. System shall be maintained in this clean condition until final acceptance. Bearings shall be lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed.

3.4.4 Testing, Adjusting, and Balancing

Testing, adjusting, and balancing shall be as specified in Section 15990 TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS.

3.5 DEMONSTRATIONS

Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The field instructions shall cover all of the items contained in the operation and maintenance manuals as well as demonstrations of routine maintenance operations.

<END>-- End of Section --
</END>

SECTION 15950
HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS
07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 500 (1989) Test Methods for Louvers, Dampers and Shutters

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 269 (1994a) Seamless and Welded Austenitic Stainless Steel Tubing for General Service

ASTM B 88 (1996) Seamless Copper Water Tube

ASTM D 635 (1991) Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

ASTM D 1693 (1994) Environmental Stress-Cracking of Ethylene Plastics

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.34 (1988) Valves - Flanged, Threaded, and Welding End

ASME B40.1 (1991) Gauges - Pressure Indicating Dial Type - Elastic Element

ASME BPV VIII Div 1 (1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

CODE OF FEDERAL REGULATIONS (CFR)

47 CFR 15 Radio Frequency Devices

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991) Surge Voltages in Low-Voltage AC Power Circuits

INTERNATIONAL SOCIETY FOR MEASUREMENT AND CONTROL (ISA)

ISA S7.3 (1975; R 1981) Quality Standard for
Instrument Air

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1991) Enclosures for Electrical Equipment
(1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1996) National Electrical Code

NFPA 90A (1993) Installation of Air Conditioning and
Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 94 (1996) Tests for Flammability of Plastic
Materials for Parts in Devices and
Appliances

UL 268A (1993; Rev Apr 1994) Smoke Detectors for
Duct Application

UL 508 (1993) Industrial Control Equipment

UL 555S (1996) Leakage Rated Dampers for Use in
Smoke-Control Systems

UL 916 (1994; Rev thru May 1996) Energy Management
Equipment

1.2 GENERAL REQUIREMENTS

1.2.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

1.2.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall investigate the mechanical, electrical, and finish conditions that could affect the work to be performed, shall arrange such work accordingly, and shall furnish all work necessary to meet such conditions.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL

PROCEDURES:

SD-01 Data

Equipment Compliance Booklet; GA.

An HVAC control system equipment compliance booklet (ECB) in indexed booklet form with numbered tabs separating the information on each device. It shall consist of, but not be limited to, data sheets and catalog cuts which document compliance of all devices and components with the specifications. The ECB shall be indexed in alphabetical order by the unique identifiers. Devices and components which do not have unique identifiers shall follow the devices and components with unique identifiers and shall be indexed in alphabetical order according to their functional name. The ECB shall include a bill of materials for each HVAC control system. The bill of materials shall function as the table of contents for the ECB and shall include the device's unique identifier, device function, manufacturer, model/part/catalog number used for ordering, and tab number where the device information is located in the ECB.

SD-04 Drawings

HVAC Control System; GA.

Drawings on A1 34 by 22 inch sheets in the form and arrangement shown. The drawings shall use the same abbreviations, symbols, nomenclature and device identifiers shown. Each control-system element on a drawing shall have a unique identifier as shown. All HVAC control system drawings shall be delivered together as a complete submittal. Drawings shall be submitted for each HVAC system.

a. HVAC control system drawings shall include the following:

Sheet One: Drawing index, HVAC control system legend.

Sheet Two: HVAC control system schematic Value Schedule and equipment schedule.

Sheet Three: HVAC control system sequence of operation and ladder diagram.

Sheet Four: HVAC control panel arrangement, control panel cross-section, and control panel inner door layout.

Sheet Five: HVAC control panel back-panel layout.

Sheet Six: Control loop wiring diagrams.

Sheet Seven: Motor starter and relay wiring diagram.

Note: Repeat sheets four through nine for each AHU system.

b. An HVAC control system drawing index showing the name and number of the building, military site, State or other similar designation, and Country. The drawing index shall list all HVAC control system drawings, including the drawing number, sheet number, drawing title, and computer filename when used.

- c. An HVAC control system legend showing generic symbols and the name of devices shown on the HVAC control system drawings.
- d. A valve schedule showing each valve's unique identifier, size, flow coefficient (Cv), pressure drop at specified flow rate, spring range, positive positioner range, actuator size, close-off pressure data, dimensions, and access and clearance requirements data.
- e. An HVAC control system equipment schedule showing the control loop, device unique identifier, device function, setpoint, input range, and additional important parameters (i.e. output range).
- f. An HVAC control system sequence of operation.
- g. An HVAC control system ladder diagram showing all relays, contacts, pilot lights, switches, fuses and starters connected to the control system.
- h. HVAC control panel arrangement drawings showing both side and front views of the panel. The drawing shall show panel and mounting dimensions.
- i. HVAC control panel cross-section drawings showing mounting rails and standoffs for devices.
- j. HVAC control panel inner door layout drawings showing both front and rear views of the inner door. The drawings shall show device locations, labels, nameplate legends, and fabrication details.
- k. HVAC control panel back-panel layout drawings showing device locations, labels, nameplate legends, terminal block layout, fabrication details, and enclosure operating temperature-rise calculations.
- l. HVAC control system wiring diagrams showing functional wiring diagrams of the interconnection of conductors and cables to HVAC control panel terminal blocks and to the identified terminals of devices, starters and package equipment. The wiring diagrams shall show all necessary jumpers and ground connections. The wiring diagrams shall show the labels of all conductors. Sources of power required for HVAC control systems and for packaged-equipment control systems shall be identified back to the panel-board circuit breaker number, HVAC system control panel, magnetic starter, or packaged equipment control circuit. Each power supply and transformer not integral to a controller, starter, or packaged equipment shall be shown. The connected volt-ampere load and the power supply volt-ampere rating shall be shown.

SD-08 Statements

Commissioning Procedures; GA

- a. Ten copies of the HVAC control system commissioning procedures, in indexed booklet form, 60 days prior to the scheduled start of commissioning. Commissioning procedures shall be provided for each HVAC control system, and for each type of terminal-unit control system. The commissioning procedures shall reflect the format and

language of this specification, and refer to devices by their unique identifiers as shown. The commissioning procedures shall be specific for each HVAC system, and shall give detailed step-by-step procedures for commissioning of the system.

- b. Commissioning procedures documenting detailed, product-specific set-up procedures, configuration procedures, adjustment procedures, and calibration procedures for each device. Where the detailed product-specific commissioning procedures are included in manufacturer supplied manuals, reference may be made in the HVAC control system commissioning procedures to the manuals.
- c. Commissioning procedures documenting controller configuration checksheets for each controller listing all configuration parameters, dip switch and jumper settings, and initial recommended P, I and D values. The configuration parameters shall be listed in the order in which they appear during the configuration process. Each configuration parameter shall be noted as being: set per specs with no field adjustment required, set per specs but field adjustable, or not applicable.
- d. Commissioning procedures showing a time clock configuration checksheet listing all parameters, and switch settings. The parameters shall be listed in the order which they appear during the setup process.
- e. An HVAC control system commissioning procedures equipment list that lists the equipment to be used to accomplish commissioning. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

Performance Verification Test Procedures; GA.

Ten copies of the HVAC control system performance verification test procedures, in indexed booklet form, 60 days before the Contractor's scheduled test dates. The performance verification test procedures shall refer to the devices by their unique identifiers as shown, shall explain, step-by-step, the actions and expected results that will demonstrate that the HVAC control system performs in accordance with the sequences of operation. An HVAC control system performance verification test equipment list shall be included that lists the equipment to be used during performance verification testing. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

SD-09 Reports

Commissioning Report; FIO.

Ten copies of the HVAC control system commissioning report, in indexed booklet form, within 30 days after completion of the system commissioning. The commissioning report shall include data collected during the HVAC control system commissioning and shall follow the format of the commissioning procedures. The commissioning report shall include all controller and time clock checksheets with final values listed for all parameters, setpoints, P, I, D setting constants, calibration data for all devices, and results of adjustments.

Performance Verification Test Report; FIO.

Ten copies of the HVAC control system performance verification test report, in indexed booklet form, within 30 days after completion of the test. The HVAC control system performance verification test report shall include data collected during the HVAC control system performance verification test. The original copies of data gathered during the performance verification test shall be turned over to the Government after Government approval of the test results.

SD-18 Records

Service Organizations; FIO.

Ten copies of a list of service organizations qualified to service the HVAC control system. The list shall include the service organization name, address, technical point of contact and telephone number, and contractual point of contact and telephone number.

SD-19 Operation and Maintenance Manuals

Operation Manual; GA.

Maintenance and Repair Manual; GA.

Ten copies of the HVAC control system operation manual and HVAC control system maintenance and repair manual for each HVAC control system 30 days before the date scheduled for the training course.

1.4 DELIVERY AND STORAGE

Products shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, and other contaminants, within the storage-condition limits published by the equipment manufacturer. Dampers shall be stored so that seal integrity, blade alignment and frame alignment are maintained.

1.5 OPERATION MANUAL

An HVAC control system operation manual for each HVAC control system, in indexed booklet form, shall be provided. The operation manual shall include the HVAC control system sequence of operation, and procedures for the HVAC system start-up, operation and shut-down. The operation manual shall include as-built HVAC control system detail drawings. The operation manual shall include the as-built controller configuration checksheets, the as-built time clock configuration checksheet, the HVAC control system front panel description, the procedures for changing HVAC system controller setpoints, the procedures for gaining manual control of processes, the time clock manufacturer's manual control of processes, the time clock manufacturer's operation manual, and the controller manufacturer's operation manual.

- a. The HVAC control system front panel description shall explain the meaning and use of the lights, switches, gauges, and controller displays located in the front panel. Each light, switch, gauge, and display described shall be numbered and referenced to a drawing of the front panel.

- b. The procedures for changing HVAC system controller setpoints shall describe the step-by-step procedures required to change: the process variable setpoints of controllers, the alarm setpoints of controllers, the controller bias settings, and controller setpoint reset schedules.
- c. The procedures for gaining manual control of processes shall describe step-by-step procedures required to gain manual control of devices and manually adjust their positions.

1.6 MAINTENANCE AND REPAIR MANUAL

An HVAC control system maintenance and repair manual for each HVAC control system, in indexed booklet form in hardback binders, shall be provided. The maintenance and repair manual shall include the routine maintenance checklist, a recommended repair methods list, a list of recommended maintenance and repair tools, the qualified service organization list, the as-built commissioning procedures and report, the as-built performance verification test procedures and report, and the as-built equipment data booklet (EDB).

- a. The routine maintenance checklist shall be arranged in a columnar format. The first column shall list all devices listed in the equipment compliance booklet (ECB), the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or reference.
- b. The recommended repair methods list shall be arranged in a columnar format and shall list all devices in the equipment compliance booklet (ECB) and state the guidance on recommended repair methods, either field repair, factory repair, or whole-item replacement.
- c. The as-built equipment data booklet (EDB) shall include the equipment compliance booklet (ECB) and all manufacturer supplied user manuals and information.
- d. If the operation manual and the maintenance and repair manual are provided in a common volume, they shall be clearly differentiated and separately indexed.

PART 2 PRODUCTS

2.1 MATERIAL AND EQUIPMENT

Material and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment

items shall be supported by a service organization. The Contractor shall submit a certified list of qualified permanent service organizations and qualifications. These service organizations shall be reasonably convenient to the equipment on a regular and emergency basis during the warranty period.

2.2 GENERAL EQUIPMENT REQUIREMENTS

2.2.1 Electrical and Electronic Devices

All electrical, electronic, and electro-pneumatic devices not located within an HVAC control panel shall have a NEMA Type 1 enclosure in accordance with NEMA 250 unless otherwise shown.

2.2.2 Standard Signals

The output of all analog transmitters and the analog input and output of all single-loop controllers and function modules shall be 4-to-20 mA_{dc} signals. The signal shall originate from current-sourcing devices and shall be received by current-sinking devices.

2.2.3 Ambient Temperature Limits

Ambient Temperature Actuators and positive positioners, and transmitters shall operate within temperature limit ratings of 40 to 140 degrees F. All panel-mounted instruments shall operate within limit ratings of 35 to 120 degrees F and 10 percent to 95 percent relative humidity, noncondensing. All devices installed outdoors shall operate within limit ratings of minus 40 to plus 150 degrees F.

2.2.4 Nameplates, Lens Caps, and Tag Nameplates

Nameplates, lens caps, and lens caps bearing legends as shown and tags bearing device-unique identifiers as shown shall have engraved or stamped characters. A plastic or metal tag shall be mechanically attached directly to each device or attached by a metal chain or wire. Each air flow measurement station shall have a tag showing flow rate range for signal output range, duct size, and identifier as shown.

2.3 MATERIALS

2.3.1 Wiring

2.3.1.1 Terminal Blocks

Terminal blocks shall be insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanism, shall be suitable for rail mounting, and shall have end plates and partition plates for separation or shall have enclosed sides.

2.3.1.2 Control Wiring for 24-Volt Circuits

Control wiring for 24-volt circuits shall be 18 AWG minimum, stranded copper and shall be rated for 300-volt service.

2.3.1.3 Wiring for 120-Volt Circuits

Wiring for 120-volt circuits shall be 18 AWG minimum, stranded copper and shall be rated for 600-volt service.

2.3.1.4 Analog Signal Wiring Circuits

Analog signal wiring circuits within control panels shall not be less than 20 AWG and shall be rated for 300-volt service.

2.3.1.5 Instrumentation Cable

Instrumentation cable shall be 18 AWG, stranded copper, single or multiple-twisted, minimum 2 inch lay of twist, 100 percent shielded pairs, and shall have a 300-volt insulation. Each pair shall have a 20 AWG tinned-copper drain wire and individual overall pair insulation. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape, overall 20 AWG tinned-copper cable drain wire, and overall cable insulation.

2.3.1.6 Nonconducting Wiring Duct

Nonconducting wiring duct in control panels shall have wiring duct in control panels shall have slotted sides, snap-on duct covers, have slotted sides, snap-on duct covers, fittings for connecting ducts, mounting clips for securing ducts, and wire-retaining clips.

2.3.1.7 Transformers

Step-down transformers shall be utilized where control equipment operates at lower than line circuit voltage. Transformers, other than transformers in bridge circuits, shall have primaries wound for the voltage available and secondaries wound for the correct control circuit voltage. Transformers shall be sized so that the connected load is 80 percent of the rated capacity or less. Transformers shall conform to UL 508.

2.4 ACTUATORS

Actuators shall be pneumatic, electric or electronic as shown and shall be provided with mounting and connecting hardware. Actuators shall fail to their spring-return positions on signal or power failure ,except that variable air volume (VAV) terminal unit actuators may be of the floating type. The actuator stroke shall be limited in the direction of power stroke by an adjustable stop. Actuators shall have a visible position indicator. Actuators shall smoothly open or close the devices to which they are applied and shall have a full stroke response time of 60 seconds or less. Electric or electronic actuators operating in series shall have an auxiliary actuator driver. Pneumatic actuators shall be rated for 25 psig operating pressure except for high-pressure cylinder-type actuators. Electric actuators shall have an oil-immersed gear train. Electric actuators used in a sequencing application shall have zero and span adjustments.

2.4.1 Valve Actuators

Valve actuators shall be selected to provide a minimum of 125 percent of the motive power necessary to operate the valve over its full range of operation.

2.5 AUTOMATIC CONTROL VALVES

2.5.1 Valve Assembly

Valves shall have stainless-steel stems and stuffing boxes with extended necks to clear the piping insulation. Unless otherwise stated, valves shall have globe style bodies. Valve bodies shall be designed for not less than 125 psig working pressure or 150 percent of the system operating pressure, whichever is greater. Valve leakage rating shall be 0.01 percent of rated Cv.

2.5.2 Two-Way Valves

Two-way modulating valves shall have equal-percentage characteristics.

2.5.3 Three-Way Valves

Three-way valves shall provide linear flow control with constant total flow throughout full plug travel.

2.5.4 Valves for Hot-Water Service

Valves for hot-water service below 250 Degrees F shall be as follows: Bodies for valves 1-1/2 inches and smaller shall be brass or bronze, with threaded or union ends. Bodies for 2 inch valves shall have threaded ends. Bodies for valves from 2 to 3 inches inclusive shall be of brass, bronze, or iron. Bodies for valves 4 inches and larger shall be iron. Bodies for valves 2-1/2 inches and larger shall be provided with flanged-end connections. Valve Cv shall be within 100 percent to 125 percent of the Cv shown. Internal trim (including seats, seat rings, modulating plugs, and springs) of valves controlling water hotter than 210 degrees F shall be Type 316 stainless steel. Internal trim for valves controlling water 210 degrees F or less shall be brass or bronze. Nonmetallic parts of hot-water control valves shall be suitable for a minimum continuous operating temperature of 250 degrees F or 50 degrees F above the system design temperature, whichever is higher. Valves 4 inches is higher. Valves 4 inches and larger shall be butterfly valves.

2.6 DAMPERS

2.6.1 Damper Assembly

A single damper section shall have blades no longer than 48 inches and shall be no higher than 72 inches. Maximum damper blade width shall be 8 inches. Larger sizes shall be made from a combination of sections. Dampers shall be steel, or other materials where shown. Flat blades shall be made rigid by folding the edges. All blade-operating linkages shall be within the frame so that blade-connecting devices within the same damper section will not be located directly in the air stream. Damper axles shall be 0.5 inch (minimum) plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings. Pressure drop through dampers shall not exceed 0.04 inch water gauge at 1,000 fpm in the wide-open position. Frames shall not be less than 2 inches in width. Dampers shall be tested in accordance with AMCA 500.

2.6.1.1 Operating Links

Operating links external to dampers (such as crankarms, connecting rods, and line shafting for transmitting motion from damper actuators to dampers) shall withstand a load equal to at least twice the maximum required damper-operating force. Rod lengths shall be adjustable. Links shall be brass, bronze, zinc-coated steel, or stainless steel. Working parts of joints and clevises shall be brass, bronze, or stainless steel. Adjustments of crankarms shall control the open and closed positions of dampers.

2.6.1.2 Damper Types

Dampers shall be parallel blade type.

2.6.2 Outside-Air, Return-Air, and Relief-Air Dampers

The dampers shall be provided where shown. Blades shall have interlocking edges and shall be provided with compressible seals at points of contact. The channel frames of the dampers shall be provided with jamb seals to minimize air leakage. Dampers shall not leak in excess of 20 cfm per square foot at 4 inches water gauge static pressure when closed. Seals shall be suitable for an operating temperature range of minus 40 to plus 200 degrees F. Dampers shall be rated at not less than 2000 fpm air velocity.

2.6.3 Mechanical and Electrical Space Ventilation Dampers

The dampers shall be as shown. Dampers shall not leak in excess of 80 cfm per square foot at 4 inches water (gauge) static pressure when closed. Dampers shall be rated at not less than 1500 fpm air velocity.

2.6.4 Damper End Switches

Each end switch shall be a hermetically-sealed switch with a trip lever and over-travel mechanism. The switch enclosure shall be suitable for mounting on the duct exterior and shall permit setting the position of the trip lever that actuates the switch. The trip lever shall be aligned with the damper blade.

2.7 DUCT SMOKE DETECTORS

Duct smoke detectors shall conform to the requirements of UL 268A. Duct smoke detectors shall have perforated sampling tubes extended into the air duct. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have manual reset. Detectors shall be rated for air velocities that include air flows between 500 and 4000 fpm. Detectors shall be powered from the HVAC control panel. Detectors shall have two sets of normally open alarm contacts and two sets of normally closed alarm contacts. Detectors shall be connected to the building fire alarm panel for alarm initiation. A remote annunciation lamp and accessible remote reset switch shall be provided for duct detectors that are mounted eight feet or more above the finished floor and for detectors that are not readily visible. Remote lamps and switches as well as each affected fan unit shall be properly identified in etched rigid plastic placards.

2.8 INSTRUMENTATION

2.8.1 Measurements

Transmitters shall be factory calibrated to provide an output of 4 to 20 mAdc over the indicated ranges:

- a. Conditioned space temperature, from 50 to 85 degrees F.
- b. Duct temperature, from 40 to 140 degrees F except that return-air temperature for economizer operation shall be minus 30 to plus 130 degrees F.
- c. Heating hot-water temperature, from 100 to 250 degrees F.
- d. Outside-air temperature, from minus 30 to 130 degrees F.
- e. Relative humidity, 0 to 100 percent for space and duct high-limit applications.

2.8.2 Temperature Instruments

2.8.2.1 Resistance Temperature Detectors (RTD)

Temperature sensors shall be 100 ohms 3- or 4-wire RTD. Each RTD shall be platinum with a tolerance of plus or minus 0.1 percent at 32 degrees F, and shall be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper. Each RTD shall be furnished with an RTD transmitter as specified, integrally-mounted unless otherwise shown.

2.8.2.3 RTD Transmitter

The RTD transmitter shall accept a 3-wire 100 ohm RTD input. The transmitter shall be a 2-wire, loop-powered device. The transmitter shall produce a linear 4-to-20 mAdc output corresponding to the required temperature measurement. The output error shall not exceed 0.1 percent of the calibrated span. The transmitter shall include offset and span adjustments.

2.8.3 Thermowells

Thermowells shall be Series 300 stainless steel with threaded brass plug and chain, 2 inch lagging neck and extension-type well, and inside diameter and insertion length as required for the application.

2.8.4 Sunshields

Sunshields for outside-air temperature sensing elements shall prevent the sun from directly striking the temperature sensing elements. The sunshields shall be provided with adequate ventilation so that the sensing element responds to the ambient temperature of the surroundings. The top of each sunshield shall have a galvanized-metal rainshield projecting over the face of the sunshield. The sunshields shall be painted white or shall be unpainted aluminum.

2.9 THERMOSTATS

Thermostat ranges shall be selected so that the setpoint is adjustable without tools between plus or minus 10 degrees F of the setpoint shown. Thermostats shall be electronic or electric.

2.9.1 Nonmodulating Room Thermostats

Contacts shall be single-pole double-throw (SPDT), hermetically sealed, and wired to identified terminals. Maximum differential shall be 5 degrees F.

Room thermostats shall be enclosed with separate locking covers (guards). Thermostats shall have manual switches as required by the application.

2.9.2 Modulating Room Thermostats

Modulating room thermostats shall have either one output signal, two output signals operating in unison, or two output signals operating in sequence, as required for the application. Each thermostat shall have an adjustable throttling range of 4 to 8 degrees F for each output. Room thermostats shall be enclosed with separate locking covers (guards).

2.9.3 Low-Temperature-Protection Thermostats

Low-temperature-protection thermostats shall be, low-temperature safety thermostats, with NO and NC contacts and manual reset, with an element length of 20 feet, which shall respond to the coldest 18 inch segment.

2.9.3.1 Heating Thermostats

Fan-coil heating thermostats shall be provided with fixed heat anticipation and shall have a single-pole, single-throw (SPST) switch hermetically sealed and actuated by a bimetallic or bellows type element. Thermostats shall be provided with external temperature setting devices with a factory set maximum of 72 degrees F. Heating thermostats shall have an adjustable range of at least 13 degrees below 72 degrees F.

2.10 INDICATING DEVICES

2.10.1 Thermometers

2.10.1.1 Piping System Thermometers

Piping system thermometers shall have brass, malleable iron or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 9 inch scale. Thermometers for piping systems shall have rigid stems with straight, angular, or inclined pattern.

2.10.1.2 Piping System Thermometer Stems

Thermometer stems shall have expansion heads as required to prevent breakage at extreme temperatures. On rigid-stem thermometers, the space between bulb and stem shall be filled with a heat-transfer medium.

2.10.1.3 Accuracy

Thermometers shall have an accuracy of plus or minus 1 percent of scale range. Thermometers shall have a range suitable for the application.

2.10.1.4 Pressure Gauges

Gauges shall be 2 inch (nominal) size, back connected, suitable for field or panel mounting as required, shall have black legend on white background, and shall have a pointer traveling through a 270-degree arc. Accuracy shall be plus or minus 3 percent of scale range. Gauges shall meet requirements of ASME B40.1.

2.11 PILOT LIGHTS AND MANUAL SWITCHES

Pilot lights and switches shall be rectangular devices arranged in a horizontal matrix as shown. Momentary switches shall be non-illuminated. Interlocking switches shall have separately illuminated sections. Split legend lights shall have separately illuminated sections. Device illumination shall be by light-emitting diode or neon lamp.

2.12 HVAC SYSTEM CONTROL PANELS

2.12.1 Panel Assembly

The control panel shall be factory assembled and shipped to the job site as a single unit. The panel shall be fabricated as shown, and the devices shall be mounted as shown. Each panel shall be fabricated as a bottom-entry connection point for control-system electric power, control-system main air source, control-system wiring, pneumatic tubing, interconnection of control systems, interconnection of starters and external shutdown devices, and energy monitoring and control systems (EMCS) interface. Each panel shall have an operating temperature rise of not greater than 20 degrees F above an ambient temperature of 100 degrees F.

2.12.2 Panel Electrical Requirements

Each control panel shall be powered by nominal 120 volts ac, fused at 5 amps, terminating at the panel on terminal blocks. Instrument cases shall be grounded. Interior panel, interior door, and exterior panel enclosure shall be grounded.

2.12.3 Enclosure

The enclosure for each panel shall be a NEMA 12 single-door wall-mounted box conforming to NEMA 250, with continuous hinged and gasketed exterior door with print pocket and key lock, continuous hinged interior door, interior back panel, and ventilation louvers in back surface as shown. Inside finish shall be white enamel, and outside finish shall be gray primer over phosphatized surfaces.

2.12.4 Mounting and Labeling

Controllers, pilot lights, switches, IP's, and pressure gauge shall be mounted on the interior door as shown. Power conditioner, fuses and duplex outlet shall be mounted on the interior of the cabinet as shown. All other components housed in the panel shall be mounted on the interior back panel surface of the enclosure, behind the door on rails as shown. Controllers and gauges mounted on the front of the inner door shall be identified by a plastic or metal nameplate as shown that is mechanically attached to the panel. Function modules, relays, timeclocks, IP transducers, DC power supply, and other devices interior to the panel shall be identified by a plastic or metal nameplate that is mechanically attached to the panel. The nameplate shall have the inscription as shown. Lettering shall be cut or

stamped into the nameplate to a depth of not less than 1/64 inch, and shall show a contrasting color, produced by filling with enamel or lacquer or by the use of a laminated material. Painting of lettering directly on the surface of the interior door or panel is not permitted.

2.12.5 Wiring and Tubing

2.12.5.1 Panel Wiring

Interconnections Wiring shall be installed in wiring ducts in such a way that devices can be added or replaced without disturbing wiring that is not affected by the change. Wiring to all devices shall have a 4 inch wiring loop in the horizontal wiring duct at each wiring connection. There shall be no wiring splices within the control panel. All interconnections required for power or signals shall be made on device terminals or panel terminal blocks, with not more than two wires connected to a terminal.

2.12.5.2 Panel Terminal Blocks

Terminal blocks shall be arranged in groups as shown. Instrument signal grounds at the same ground reference level shall end at a grounding terminal for connection to a common ground point. Wiring-shield grounds at the same reference level shall end at a grounding terminal for connection to a common ground point. Grounding terminal blocks shall be identified by reference level.

2.12.5.3 Wiring Identification

All wiring connected to controllers, time clocks and function modules shall be identified by function and polarity with full word identifiers, i.e., process variable input, remote setpoint input and control output.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION CRITERIA

The HVAC control system shall be installed and ready for operation, as specified and shown. Dielectric isolation shall be provided where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exterior shall be made watertight. The HVAC control system installation shall provide clearance for control system maintenance by maintaining access space between coils, access space to mixed-air plenums, and other access space required to calibrate, remove, repair, or replace control system devices. The control system installation shall not interfere with the clearance requirements for mechanical installation shall not interfere with the clearance requirements for mechanical and electrical system maintenance.

3.1.1 Device Mounting Criteria

Devices mounted in or on piping or ductwork, on building surfaces, in mechanical/electrical spaces, or in occupied space ceilings shall be installed in accordance with manufacturer's recommendations and as shown. Control devices to be installed in piping and ductwork shall be provided with all required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Strap-on temperature sensing elements shall not be used

except as specified.

3.1.2 Wiring Criteria

Wiring external to control panels, including low-voltage wiring, shall be installed in metallic raceways. Wiring shall be installed without splices between control devices and HVAC control panels. Cables and conductors shall be tagged at both ends, with the identifier shown on the shop drawings, in accordance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Other electrical work shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR and as shown.

3.1.2.1 Power-Line Surge Protection

Equipment connected to ac circuits shall be protected from powerline surges. Equipment protection shall meet the requirements of IEEE C62.41. Fuses shall not be used for surge protection.

3.1.2.2 Surge Protection for Transmitter and Control Wiring

HVAC system control panel equipment shall be protected against surges induced on control and transmitter wiring installed outside and as shown. The equipment protection shall be tested in the normal mode and in the common mode, using the following two waveforms:

- a. A 10-microsecond by 1000-microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8-microsecond by 20-microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

3.1.2.3 Controller Output Loop Impedance Limitation

Controller output loops shall be constructed so that total circuit impedance connected to the analog output of a single-loop controller shall not exceed 600 ohms.

3.2 CONTROL SYSTEM INSTALLATION

3.2.1 Damper Actuators

Actuators shall not be mounted in the air stream. Multiple actuators operating a common damper shall be connected to a common drive shaft. Actuators shall be installed so that their action shall seal the damper to the extent required to maintain leakage at or below the specified rate and shall move the blades smoothly.

3.2.2 Room-Instrument Mounting

Room instruments shall be mounted so that their sensing elements are 5 feet above the finished floor unless otherwise shown. Temperature setpoint device shall be recess mounted.

3.2.3 Smoke Detectors

Duct smoke detectors shall be provided in supply and return air ducts in accordance with NFPA 90A.

3.2.4 Manual Emergency Fan Shutdown Switches

Manual emergency fan shutdown switches shall be provided for air distribution fans in accordance with NFPA 90A. Switches shall be the manual-reset type. Switches shall be located and mounted in an accessible manner, approximately 48 inches above the finished floor. Switches shall be properly identified in etched rigid plastic placards.

3.2.5 Low-Temperature-Protection Thermostats

For each 20 square feet of coil-face area, or fraction thereof, a thermostat shall be provided to sense the temperature at the location shown. The thermostat sensing element shall be installed in a serpentine pattern.

3.2.6 Foundations and Housekeeping Pads

Foundations and housekeeping pads shall be provided for the HVAC control system air compressors.

3.2.7 Indication Devices Installed in Piping and Liquid Systems

Gauges in piping systems subject to pulsation shall have snubbers. Gauges for steam service shall have pigtail fittings with cock. Thermometers and temperature sensing elements installed in liquid systems shall be installed in thermowells.

3.3 CONTROL SEQUENCES OF OPERATION

3.3.1 System Requirements

These requirements shall apply to all primary HVAC systems unless modified herein. The sequences describe the actions of the control system for one direction of change in the HVAC process analog variable, such as temperature, humidity or pressure. The reverse sequence shall occur when the direction of change is reversed.

3.3.1.1 HVAC System Supply Fan Operating

HVAC system outside-air, return-air, and relief-air dampers shall function as described hereinafter for specific modes of operation. Heating coil valves shall be under control.

3.3.1.2 HVAC System Supply Fan Not Operating

When an HVAC system is stopped, all stages of direct-expansion cooling shall stop, the system shall pump down if it has a pump down cycle. Heating-coil valves shall remain under control.

3.3.1.3 HVAC System Hydronic Heating Distribution Pump Operation

Hydronic heat-exchanger valves shall be under control.

3.3.1.4 HVAC System Hydronic Heating Distribution Pump Not Operating

Hydronic heat-exchanger valves shall close.

3.3.2 Perimeter-Radiation Control Sequence

A room thermostat, located as shown, shall operate a control valve to maintain the setpoint as shown.

3.3.3 Unit-Heater

A wall-mounted thermostat with an "AUTO-OFF" switch located as shown, shall cycle the fan to maintain its setpoint as shown when the switch is in the "AUTO" position. When the switch is in the "OFF" position, the fan shall be stopped.

3.3.4 Single Building Hydronic Heating with Hot Water Boiler

- a. All Modes - The outside-air temperature controller shall accept a signal at its process variable input from a sunshielded outside-air temperature sensing element and transmitter located as shown. The outside-air temperature controller process variable relay contact output shall start and stop the distribution pump at the outside-air temperatures shown. The analog output of the outside-air temperature controller shall send a signal to the remote setpoint input of the primary hydronic-heating system temperature controller to reset the hydronic-heating supply temperature setpoint in a linear schedule based on the outside-air temperature as shown. The hydronic-heating supply temperature controller shall accept a signal at its process variable input from a temperature sensing element and transmitter located in the hydronic-heating supply line and the controller output shall modulate the hydronic-heating system control valve to maintain the reset schedule setpoint in the hydronic-heating supply line.
- b. Occupied Mode - When the timeclock places the system in the occupied mode, a space-temperature sensing element and transmitter located as shown shall signal a space-temperature controller which shall maintain the setpoint as shown by modulating the secondary-hydronic-system zone valve. In this mode of operation, the controller setpoint shall be adjustable from the sensor and transmitter location.
- c. Unoccupied Mode - When the timeclock places the system in the unoccupied mode, the setpoint of the controller shall be as shown and shall be adjustable at the HVAC control panel.

3.3.5 Heating and Ventilating Sequence

3.3.5.1 Occupied, Unoccupied, and Ventilation-Delay Operating Modes

Ventilation-delay-mode timing shall start prior to the occupied-mode timing. The timeclock shall close a contact, which shall turn on the ventilation-delay pilot light and energize a relay which shall prevent the outside-air damper from opening. At the time shown, the timeclock shall close a contact which shall turn on the occupied-mode pilot light and shall place the system in the occupied mode. At the expiration of the ventilation-delay-mode timing period, the timeclock shall open the contact to turn off the ventilation-delay-mode pilot light and de-energize a relay to allow the outside-air damper to open. At the time shown, the timeclock shall open the contact to turn off the occupied-mode pilot light and shall

place the control system in the unoccupied mode of operation.

3.3.5.2 Outside-Air, Return-Air, and Relief-Air Dampers

- a. Occupied Mode - The outside-air, return-air, and relief-air dampers shall be under space temperature control.
- b. Unoccupied and Ventilation-Delay Modes - The dampers shall return to their normal positions.

3.3.5.3 Supply-Fan Control

- a. Occupied and Ventilation-Delay Modes - Supply fan shall start and shall operate continuously.
- b. Unoccupied Mode - The supply fan shall cycle from a night-thermostat. The fan shall start at and stop at the setpoints as shown.

3.3.5.4 Filter

A differential-pressure switch across the filter shall turn on the filter pilot light when the pressure drop across the filter reaches the setpoint as shown.

3.3.5.5 Freeze Protection

All Modes - A freezestat, located as shown, shall stop the supply fan, cause the outside-air, return-air, and relief-air dampers to return to their normal position as shown; and turn on the low-temperature pilot light in the HVAC control panel if the temperature drops below the freezestat's setpoint as shown. Return to the normal mode of operation shall require manual reset at [the freezestat and at] the HVAC control panel.

3.3.5.6 Space Temperature Control

A space-temperature sensing-element and transmitter operating through a space-temperature controller shall first gradually shut off the heating-coil valve. After the heating-coil valve is fully closed, the controller shall then gradually operate the outside-air damper to admit outside air beyond the minimum quantity to maintain the setpoint as shown.

3.3.5.7 Emergency Fan Shutdown

Activation of a duct smoke detector in the supply-air or return-air ductwork, or activation of a manual emergency fan shutdown switch shall cause the associated fan to shutdown in accordance with NFPA 90A. Activation of these devices shall operate a pilot light on the HVAC control panel. The panel shall require manual resetting after the detector and the manual switch are reset.

3.3.6 Multizone Control Sequence with Return Fan

Multizone control sequence shall consist of the following:

3.3.6.1 Occupied, Unoccupied, and Ventilation-Delay Modes

Ventilation-delay-mode timing shall start prior to the occupied-mode timing. The timeclock shall close a contact, which shall turn on the ventilation-delay pilot light and energize a relay which shall prevent the outside-air damper from opening. At the time shown, the timeclock shall close a contact which shall turn on the occupied-mode pilot light and shall place the system in the occupied mode. At the expiration of the ventilation-delay-mode timing period, the timeclock shall open the contact to turn off the ventilation-delay-mode pilot light and de-energize a relay to allow the outside-air damper to open. At the time shown, the timeclock shall open the contact to turn off the occupied-mode pilot light and shall place the control system in the unoccupied mode of operation.

3.3.6.2 Supply-Fan and Return-Fan Control

- a. Occupied and Ventilation-Delay Modes - Supply fan shall start, and operate continuously.
- b. Unoccupied Mode - The supply fan and the return fan shall cycle from a night-thermostat. The fans shall start at and stop at the setpoints as shown.

3.3.7 Filter

A differential-pressure switch across the filter shall turn on the filter pilot light when the pressure drop across the filter reaches the setpoint as shown.

3.3.8 Freeze Protection

All Modes - A freezestat, located as shown, shall stop the supply and return fans, cause the outside air, return air, and relief air dampers to return to their normal position as shown, and shall turn on the low-temperature pilot light in the HVAC control panel if the temperature drops below the freezestat's setpoint as shown. Return to the normal mode of operation shall require manual reset at the HVAC control panel.

3.3.8.1 Direct Expansion Cooling Coil

- a. Occupied and Ventilation-Delay Modes - The stages of cooling shall be operated by the space-temperature controller.
- b. Unoccupied Mode - The space-temperature controller output signal shall be interrupted and cooling shall be off.

3.3.9 Space-Temperature-Sequenced Heating and Cooling Control

A space-temperature sensing element and transmitter operating through a space-temperature controller shall maintain the setpoint by sequencing the heating coil valve, dampers, and stages of DX cooling as shown. On a rise in space temperature, the controller shall first gradually close the heating-coil valve. After the controller output passes through a deadband, the controller shall then gradually operate the outside-air damper to admit outside air beyond the minimum quantity, except that when the economizer controller places the system in the minimum-outside-air mode, the outside-air damper shall be open to the setting as determined by the minimum-position switch. After the outside-air damper is fully open, upon

a further rise in space temperature, the controller shall then operate the stages of cooling in sequence to maintain the setpoint as shown.

3.3.10 Emergency Fan Shutdown

Activation of a duct smoke detector in the supply-air or return-air ductwork, or activation of a manual emergency fan shutdown switch shall cause the associated fan to shutdown in accordance with NFPA 90A. Activation of these devices shall operate a pilot light on the HVAC control panel. The panel shall require manual resetting after the detector and the manual switch are reset.

3.4 COMMISSIONING PROCEDURES

3.4.1 General Procedures

3.4.1.1 Evaluations

The Contractor shall make the observations, adjustments, calibrations, measurements, and tests of the control systems, tune the controllers, set the timeclock schedule, and make any necessary control-system corrections to ensure that the systems function as described in paragraph CONTROL SEQUENCES OF OPERATION. The Contractor shall permanently record, on system equipment schedule, the final setting of controller proportional, integral and derivative constant settings, setpoint, manual reset setting, maximum and minimum controller output, and ratio and bias settings, in units and terminology specific to the controller.

3.4.1.2 Item Check

An item-by-item check of the sequence of operation requirement shall be performed using Steps 1 through 4 in the specified control system commissioning procedures. Steps 1, 2, and 3 shall be performed with the HVAC system shutdown; Step 4 shall be performed after the HVAC systems have been started. Signals used to change the mode of operation shall originate from the actual HVAC control device intended for the purpose, such as the time clock. External input signals to the HVAC control panel (such as EMCS, starter auxiliary contacts, and external systems) may be simulated in Steps 1, 2, and 3. With each operational-mode change signal, pilot lights and HVAC-panel output-relay contacts shall be observed to ensure that they function. All terminals assigned to EMCS shall be checked and observed to ensure that the proper signals are available.

3.4.1.3 Weather-Dependent Test Procedures

Weather-dependent test procedures that cannot be performed by simulation shall be performed in the appropriate climatic season. When simulation is used, the Contractor shall verify the actual results in the appropriate season.

3.4.1.4 Configuration

The Contractor shall configure each controller for its specified service.

3.4.1.5 Two-Point Accuracy Check

A two-point accuracy check of the calibration of each HVAC-control-system

sensing element and transmitter shall be performed by comparing the HVAC-control-panel readout to the actual value of the variable measured at the sensing element and transmitter or airflow measurement station location. Digital indicating test instruments shall be used, such as digital thermometers, motor-driven psychrometers, and tachometers. The test instruments shall be at least twice as accurate as the specified sensing element-to-controller readout accuracy. The calibration of the test instruments shall be traceable to NIST standards. The first check point shall be with the HVAC system in the shutdown condition, and the second check point shall be with the HVAC system in an operational condition. Calibration checks shall verify that the sensing element-to-controller readout accuracies at two points are within the specified product accuracy tolerances. If not, the device shall be recalibrated or replaced and the calibration check repeated.

3.4.1.6 Insertion, Immersion Temperature

Insertion-temperature and immersion-temperature sensing element and transmitter-to-controller readout calibration accuracy shall be checked at one physical location along the axis of the sensing element.

3.4.1.7 Averaging Temperature

Averaging-temperature sensing element and transmitter-to-controller readout calibration accuracy shall be checked every 2 feet along the axis of the sensing element in the proximity of the sensing element, for a maximum of 10 readings. These readings shall then be averaged.

3.4.1.8 Single-Zone with Hydronic Heating and Cooling Coils; No Return Fan

Steps for installation shall be as follows:

- a. Step 1 - System Inspection: The HVAC system shall be verified in its shutdown condition. Power and main air shall be available at the HVAC system control panel. The outside-air and relief-air dampers shall be closed, the return-air damper shall be open, and the cooling-coil valve shall be closed.
- b. Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature-sensing element location. Each controller display shall be read, and the thermometer and controller-display readings logged. The calibration accuracy of the sensing element-to-controller readout for outside-air, return-air, and space temperatures shall be checked.
- c. Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator, using the controller "MANUAL/AUTO" station in "MANUAL." The proper operation of the actuators and positioners for all dampers and valves shall be verified. The signal shall be varied from live zero of 4 ma [or 3 psig] to 20 ma [or 15 psig], and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. It shall be verified that all sequenced and parallel-operated actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other.

d. Step 4 - Control-System Commissioning:

(1) With the fan ready to start, the ventilation-delay-mode signal shall be applied, and it shall be verified that the ventilation-delay-mode pilot light turns on. The occupied-mode signal shall be applied, and it shall be verified that the occupied-mode pilot light turns on and that supply fan starts. It shall be verified that the outside-air and relief-air dampers are closed, the return-air damper is open, and the heating-coil and cooling-coil valves are under control, by slightly changing the controller outputs. The ventilation-delay-mode signal shall be released, and it shall be verified that the ventilation-delay-mode pilot light turns off and that the outside-air, return-air, and relief-air dampers come under control by changing the controller output.

(2) The minimum-outside-air-mode signal shall be applied. It shall be verified that the outside-air damper opens to minimum position and the economizer pilot light is off.

(3) The space-temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position. An economizer-mode input signal shall be simulated and it shall be verified that the economizer-mode pilot light turns on. The space-temperature controller output shall be changed and the second point of the two-point calibration accuracy check of sensing element-to-controller readout for outside-air, return-air, and space temperatures shall be performed. The controller shall be placed in the remote-setpoint mode. The setpoint low-end limit shall be set to 66 degrees F and the high-end limit shall be set to 72 degrees F. Proper operation of the temperature setpoint device at the space-temperature sensing element and transmitter location shall be verified. The space-temperature controller tuning procedure shall be performed. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position and the temperature setpoint device shall be set to the space temperature setpoint as shown. A change in space temperature shall be simulated and it shall be verified that the heating-coil valve and the cooling-coil valve operate in sequence as shown.

(4) An unoccupied-mode signal shall be applied, and it shall be verified that the occupied-mode pilot light turns off, the HVAC system shuts down, and the control system assumes the specified shutdown conditions. The night-thermostat temperature setting shall be turned upward, and it shall be verified that the HVAC system starts; the setting shall be turned downward, and it shall be verified that the HVAC system stops. The night thermostat shall be set at the setpoint as shown.

(5) With the HVAC system running, a filter differential-pressure switch input signal shall be simulated at the device. It shall be verified that the filter pilot light turns on, and that contact output at the EMCS terminals is made. The differential-pressure switch shall be set at the setpoint as shown.

(6) With the HVAC system running, a freezestat trip input signal shall be simulated at the device. HVAC system shutdown shall be verified, the low-temperature pilot light shall turn on, and

contact output at the EMCS terminals shall be verified. The freezestat shall be set at the setpoint as shown. The HVAC system shall be restarted by manual restart, and it shall be verified that the pilot light turns off.

(7) With the HVAC system running, a smoke-detector trip input signal shall be simulated at each detector, and control-device actions and interlock functions, as described in paragraph CONTROL SEQUENCES OF OPERATION shall be verified. Simulation shall be performed without false-alarming any Life Safety systems. It shall be verified that the HVAC system shuts down and that the smoke-detector pilot light turns on, and contact output at the EMCS terminals is made. The detectors shall be reset. The HVAC system shall be restarted by manual restart, and it shall be verified that the pilot light turns off.

3.5 BALANCING, COMMISSIONING, AND TESTING

3.5.1 Coordination with HVAC System Balancing

Commissioning of the control system, except for tuning of controllers, shall be performed prior to or simultaneous with HVAC system balancing. The Contractor shall tune the HVAC control system after all air-system and hydronic-system balancing has been completed, minimum damper positions set and a report has been issued.

3.5.2 Control System Calibration, Adjustments, and Commissioning

Control system commissioning shall be performed for each HVAC system, using test plans and procedures previously approved by the Government. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform commissioning and testing of the HVAC control system. All instrumentation and controls shall be calibrated and the specified accuracy shall be verified using test equipment with calibration traceable to NIST standards. Wiring shall be tested for continuity and for ground, open, and short circuits. Tubing systems shall be tested for leaks. Mechanical control devices shall be adjusted to operate as specified. HVAC control panels shall be pretested off-site as a functioning assembly ready for field connections, calibration, adjustment, and commissioning of the operational HVAC control system. Written notification of any planned commissioning or testing of the HVAC Control systems shall be given to the Government at least 14 calendar days in advance.

3.5.3 Performance Verification Test

The Contractor shall demonstrate compliance of the HVAC control system with the contract documents. Using test plans and procedures previously approved by the Government, the Contractor shall demonstrate all physical and functional requirements of the project. The performance verification test shall show, step-by-step, the actions and results demonstrating that the control systems perform in accordance with the sequences of operation. The performance verification test shall not be started until after receipt by the Contractor of written permission by the Government, based on Government approval of the commissioning report and completion of balancing. The tests shall not be conducted during scheduled seasonal off-periods of base heating and cooling systems.

3.5.4 Posted and Panel Instructions

Posted and panel instructions, showing the final installed conditions, shall be provided for each system. The posted instructions shall consist of half-size laminated drawings and shall include the control system schematic, equipment schedule, ladder diagram, sequence of operation, panel arrangement drawings, wiring diagram, and valve and damper schedules. The posted instructions shall be permanently affixed, by mechanical means, to a wall near the control panel. Panel instructions shall consist of laminated letter-size sheets and shall include a routine maintenance checklist and controller configuration check sheets with final configuration record for each controller. Panel instructions and one copy of the operation and maintenance manuals, previously described herein, shall be placed inside each control panel.

3.6 TRAINING

3.6.1 Training-Course Requirements

A training course shall be conducted for operating staff members designated by the Contracting Officer. The training period, for a total of 8 hours of normal working time, shall be conducted within 30 days after successful completion of the performance verification test. The training course shall be conducted at the project site. Audiovisual equipment and ten sets of all other training materials and supplies shall be provided. A training day is defined as 8 hours of classroom instruction, including two 15-minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility.

3.6.2 Training-Course Content

For guidance in planning the required instruction, the Contractor shall assume that attendees will have a high school education or equivalent, and are familiar with HVAC systems. The training course shall cover all of the material contained in the operating and maintenance instructions, the layout and location of each HVAC control panel, the layout of one of each type of unitary equipment and the locations of each, the location of each system-control device external to the panels, the location of the compressed-air station, preventive maintenance, troubleshooting, diagnostics, calibration, adjustment, commissioning, tuning, and repair procedures. Typical systems and similar systems may be treated as a group, with instruction on the physical layout of one such system. The results of the performance verification test and the calibration, adjustment and commissioning report shall be presented as benchmarks of HVAC control-system performance by which to measure operation and maintenance effectiveness.

-- End of Section --

SECTION 16641

CATHODIC PROTECTION SYSTEM (STEEL WATER TANKS) 07/98 [AMEND 0001]

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1248 (1984; R 1989) Polyethylene Plastics
Molding and Extrusion Materials

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA FU 1 (1986) Low Voltage Cartridge Fuses
NEMA TC 2 (1990) Electrical Polyvinyl Chloride (PVC)
Tubing (EPT) and Conduit (EPC-40 and EPC-80)
NEMA WC 5 (1992; Rev Dec 1993)
Thermoplastic-Insulated Wire and Cable for
the Transmission and Distribution of
Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1993) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 6 (1993) Rigid Metal Conduit
UL 467 (1993) Grounding and Bonding Equipment
UL 506 (1994; Rev Jul 1994) Specialty Transformers
UL 510 (1986; Rev Oct 1986) Insulating Tape
UL 514A (1991; Rev Apr 1993) Metallic Outlet Boxes

1.2 GENERAL REQUIREMENTS

1.2.1 Services of Corrosion Engineer

The Contractor shall obtain the services of a corrosion engineer to supervise and inspect the installation of the cathodic protection system.

Corrosion Engineer refers to a person, who, by reason of his knowledge of the physical sciences and the principles of engineering and mathematics acquired by professional education and related practical experience, is qualified to engage in the practice of corrosion control on steel water tanks. Such person may be a licensed professional engineer or may be a person certified as being qualified by the National Association of Corrosion Engineers if such licensing or certification includes suitable experience in corrosion control on steel water tanks.

The Corrosion Engineer shall insure that the cathodic protection system is installed, tested, and placed into service in accordance with the requirements specified.

1.2.2 Rules

The installation shall conform to the applicable rules of NFPA 70.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-01 Data

Spare Parts; FIO.

Spare parts data for each different item of material and equipment specified, after approval of the detail drawings and not later than one month prior to the date of beneficial occupancy. The data shall include a complete list of parts, special tools, and supplies with current unit prices and source of supply.

SD-04 Drawings

Cathodic Protection System; GA.

Detail drawings consisting of a complete list of equipment and materials including manufacturer's descriptive and technical literature, catalog cuts, installation instructions and certified test data stating the maximum recommended anode current output density and the rate of gaseous production if any at that current density. Detail drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function properly as a unit.

SD-08 Statements

Qualifications; GA.

Evidence of qualifications of the corrosion engineer.

SD-09 Reports

Tests and Measurements; GA.

Test reports in booklet form tabulating all field tests and measurements, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

SD-19 Operation and Maintenance Manuals

Cathodic Protection System; GA.

Six copies of operating instructions outlining the step-by-step procedures required for system startup, operation and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. The instructions shall include diagrams for the system as installed, instructions in making tank-to-reference electrode measurements and frequency of monitoring.

PART 2 PRODUCTS

2.1 IMPRESSED CURRENT ANODES

2.1.1 High Silicon Cast Iron Anodes

Cast iron anodes shall be of the size indicated and shall conform to the following requirements:

2.1.1.1 Chemical Composition (Nominal)

Element	Percent by Weight	
	Grade 1	Grade 2
Silicon	14.20-14.75	14.20-14.75
Manganese	1.50 max.	1.50 max.
Carbon	0.70-1.10	0.75-1.15
Chromium	-----	3.25-5.00
Iron	Balance	Balance

2.1.1.2 Electrical Resistivity

Seventy-two microhm-centimeter at 20 degrees F (maximum).

2.1.1.3 Physical Properties (Nominal)

Tensile strength	15,000 psi
Compressive strength	100,000 psi
Brinell hardness	520
Density	7.0 grams per cubic centimeter
Melting point	2300 degrees F
Coefficient of	0.00000733 centimeter per degree F

Element	Percent by Weight	
	Grade 1	Grade 2
expansion from 32 to 212 degrees F		

2.1.2 Miscellaneous Anodes

2.1.2.1 Aluminum Anodes

Aluminum anodes shall have the following nominal composition:

Element	Percent by Weight, Maximum
Copper	4.0
Magnesium	0.5
Manganese	0.5
Aluminum	Balance

2.1.2.2 Precious Metal Anodes

Precious metal anodes shall be solid, composite, wire, rod, expanded mesh, or ribbon in form, per recommendation of the Corrosion Engineer.

2.1.2.3 Graphite Anodes

Graphite anodes shall have a maximum electrical resistivity of 0.0011 ohm-centimeter.

2.1.3 Anode Connecting Cables

Anodes shall have connecting cables installed at the factory. The Contractor shall submit a certified test report showing that the connecting method has passed a 120-day laboratory test without failure at the place of connection wherein the anode was subjected to maximum recommended current output while immersed in a 3 percent sodium chloride solution. Aluminum anodes connected together by a threaded system shall have water-tight seals and be electrically continuous.

2.2 RECTIFIERS AND ASSOCIATED EQUIPMENT

2.2.1 Rectifier Unit

Rectifier unit shall consist of a transformer, rectifying elements, transformer tap adjuster, terminal block, one dc output voltmeter, one dc output ammeter, one toggle switch for each meter, fuse holders with fuses for each dc circuit, variable resistors, an ac power-supply circuit breaker, lightning arresters for both input and output; all wired and assembled in a weatherproof metal cabinet. The overall efficiency of the rectifier shall be not less than 65 percent when operated at nameplate rating and shall be capable of supplying continuous full rated output at an

ambient temperature of 112 degrees F in full sunlight with expected life in excess of 10 years.

2.2.1.1 Transformer

Transformer shall conform to UL 506.

2.2.1.2 Rectifying Elements

Rectifying elements shall be silicon diodes or selenium cells connected in such manner as to provide full-wave rectification. Silicon diodes shall be protected by selenium surge cells or varistors against over-voltage surges and by current limiting devices against over-current surges.

2.2.1.3 Meters

Meters shall be accurate to within plus or minus 2 percent of full scale at 80 degrees F, and shall possess temperature stability above and below 80 degrees F of at least 1 percent per 10 degrees F. Separate meters shall be 2-1/2 inch nominal size or larger.

2.2.1.4 Circuit Breaker

A single-pole, flush-mounted, fully magnetic, properly rated nonterminal type circuit breaker shall be installed in the primary circuit of the rectifier supply transformer.

2.2.1.5 Fuses

Cartridge-type fuses conforming to NEMA FU 1 with suitable fuse holders shall be provided in each leg of the dc circuit.

2.2.2 Cabinet

Cabinet shall be constructed of not lighter than No. 16-gauge steel, and shall be provided with a full door. The door shall be hinged and have a hasp that will permit the use of a padlock. The cabinet shall be fitted with screened openings of the proper size to provide for adequate cooling. Holes, conduit knockouts, or threaded hubs of sufficient size and number shall be conveniently located.

2.2.2.1 Wiring Diagram

A complete wiring diagram of the power unit showing both the ac supply and the dc connections to anodes shall be on the inside of the cabinet door. All components shall be shown and labeled.

2.2.2.2 Grounding

Grounding provisions shall comply with NFPA 70 and UL 467 including a ground terminal in the cabinet. The grounding conductor from the terminal to the earth grounding system shall be solid or stranded copper not smaller than No. 6 AWG. The earth grounding system shall consist of one or more 5/8 inch diameter copper-clad steel rods. Ground rods shall be 8 feet long minimum.

2.2.2.3 Painting

The cabinet and supporting mounting shall be painted with the manufacturer's standard paint system.

2.2.3 Wiring

Wiring shall be installed in accordance with NFPA 70 utilizing type TW or RHW or polyethylene insulation. Fittings for conduit and cable work shall conform to UL 514A. Outlets shall be of the threaded hub type with gasketed covers. Conduit shall be securely fastened at 8 foot intervals or less. Splices shall be made in outlet fittings only. Conductors shall be color coded for identification.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Reference Electrodes

The electrodes shall be copper-copper sulphate type provided with micro-pore diffusion window for water contact and water-tight plug for renewal of copper sulphate crystals and solution.

2.3.2 Automatic Cathodic Protection Control

The system shall be capable of maintaining a tank-to-water potential criterion of protection within plus or minus 0.025 volt regardless of changes in water chemistry, temperature, or water level in the tank. Provision shall be made for readily changing the range and limits of the criterion.

2.3.3 Electrical Wire and Associated Materials

2.3.3.1 Anode Connecting Wire

Anode connecting wire shall be No.8 AWG stranded copper wire with type CP high molecular weight polyethylene insulation, 7/64 inch thick, 600 volt rating, in accordance with NEMA WC 5. Cable-to-anode contact resistance shall be 0.003 ohms maximum.

2.3.3.2 Anode Header Cable

Cable for anode header and distribution shall be 8 AWG stranded copper wire with type CP high molecular weight polyethylene, 7/64 inch thick insulation, 600-volt rating, in accordance with NEMA WC 5.

2.3.3.3 Reference Electrode Wire

Reference electrode wire shall be stranded copper wire with NFPA 70 type RHW-USE or polyethylene insulation.

2.3.4 Conduit

Rigid galvanized steel conduit and accessories shall conform to UL 6. Nonmetallic conduit shall conform to NEMA TC 2.

2.3.5 Test Boxes and Junctions Boxes

Boxes shall be outdoor type conforming to UL 514A.

2.3.6 Polyethylene Insulation

Polyethylene insulation shall comply with the requirements of ASTM D 1248 and of the following types, classes, and grades:

2.3.6.1 High Molecular Weight Polyethylene

High molecular weight polyethylene shall be Type I, Class C, Grade E5.

2.3.6.2 High Density Polyethylene

High density polyethylene shall be Type III, Class C, Grade E3.

2.3.7 Pressure-Sensitive Vinyl Tape

Pressure-Sensitive Vinyl Plastic Electrical Tape: Tape shall conform to UL 510.

PART 3 EXECUTION

3.1 ANODES

3.1.1 Anode Installation

Anodes shall be suspended to prevent icing damage to anodes and suspending cables. The Contractor shall certify that the method has been used successfully for similar applications.

Anodes shall be suspended from roof plate or structurals by means of factory installed connecting wire designed to support the anodes in air (before submergence) without failure of the electrical wire insulation or the electrical conductor.

Anodes shall be suspended in a way that will prevent contact with tank surfaces and shall be hung clear of man-access roof hatches and such items as ladders, heater pipes, and stay rods.

Anode hangers shall electrically insulate the anode suspending wire from the tank steel.

A handhole having a minimum diameter of 6 inches shall be provided in the tank roof for each anode string to permit replacement or inspection of anodes.

3.1.2 Anode Connections

Anodes shall be electrically connected to the positive dc header cable with compression connectors or split bolts, or the header cable may terminate in a junction box for connection with all anode cables. A minimum of two split bolts shall be used for each connection if split bolts are used.

Header cable shall be installed on the underside of the roof with electrically insulating hangers and shall enter the tank near the roof line from an externally mounted junction box. External wiring shall be in conduit.

All under-roof electric wire splices shall be made above the high water line and sealed water tight using a minimum of two 1/2-lap layers of butyl rubber tape followed by two 1/2-lap layers of plastic tape.

3.2 RECTIFIERS

3.2.1 Rectifier and Control Installation

Mounting shall be as shown.

3.2.2 Grounding

The grounding system for grounding rectifier cabinets shall have a resistance to earth of not more than 25 ohms as determined by an approved method.

3.3 PERMANENT REFERENCE ELECTRODES

3.3.1 Calibration

Permanent reference electrodes shall be calibrated against a standard electrode before installation. Calibration shall be done in a test tank containing water with the same composition as the tank to be protected. The permanent electrodes shall measure reference voltage agreeing with that measured by the standard electrode within plus or minus 0.005 volt when the sensing windows of the two electrodes being compared are not more than 1/6 inch apart but not touching.

3.3.2 Installation

Reference electrodes shall be operable under the same icing conditions as the anode system.

Installation of permanent reference electrodes shall be made at points in the tank which will monitor minimum and maximum tank-to-water potentials and as otherwise needed for automatic control system.

Sensing windows of reference electrodes shall be located between 1/4 inch and 1/2 inch away from the steel surface sensed and shall be fixed in position preventing contact with tank steel.

3.4 CRITERIA OF PROTECTION

3.4.1 Minimum

The criterion of protection shall be a negative voltage of at least minus 0.85 volt as measured between the tank and a saturated copper-copper-sulphate reference electrode. Determination of this voltage shall be made with the cathodic protection system in operation.

3.4.2 Maximum

In order to mitigate disbonding of the interior coating in the tank, potential between a copper-copper-sulphate reference electrode and the tank at any point shall not be more negative than minus 1.1 volt measured with the electrode located between 1/4 inch and 1/2 inch and away from the steel surface but not touching it.

3.5 TESTING, ADJUSTING, AND PLACING IN SERVICE

3.5.1 Testing

Upon completion of the installation, the tank shall be filled to maximum working level. The rectifier shall be energized and adjusted to provide current to the anodes at the level that will protect the tank. The measurements detailed below shall be made with voltmeters having a sensitivity not less than 100,000 ohms per volt.

3.5.1.1 Tank-to-Water Potential Measurements

The following series of tank-to-water potential measurements with a portable reference electrode placed not more than 1/2 inch away from but not touching the tank wall shall be performed:

- a. On a vertical line midway between two anode strings beginning at a point 1 foot below water level and continuing at points 3 feet apart until the bottom of the tank is reached.
- b. On a second vertical line midway between two anode strings on the opposite side of the tank from the first vertical line beginning at a point 1 foot below water level and continuing at points 3 feet apart until the bottom of the tank is reached.
- c. Across the bottom of the tank in a line between the two vertical lines at 3 foot intervals.
- d. In at least four places which are closest to anodes.

3.5.1.2 Reference Electrode Calibration

The portable reference electrode used for the test shall be calibrated against the standard electrode specified in paragraph PERMANENT REFERENCE ELECTRODES.

3.5.1.3 Test Measurement Recording

All test measurements and their locations, as well as measurements made with the permanent electrodes simultaneously with the test measurements, shall be recorded.

3.5.2 Adjusting

Final adjustment of the rectifier output current shall be made so that repeated voltage readings taken as specified for testing meet the criteria in paragraph CRITERIA OF PROTECTION.

3.5.3 Placing in Service

After final adjustment the cathodic protection system shall be placed in service and the condition of the system as left by the Contractor shall be recorded and shall indicate transformer tap settings; voltage readings from reference electrode to tank, readings both horizontal and vertical; automatic control differential setting; ac supply voltage; adjusted dc output voltage; and total protective current.

3.6 TRAINING

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 4 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. The field instructions shall cover all of the items contained in the operating and maintenance instructions, as well as demonstrations of routine maintenance operations. The Contracting Officer shall be notified at least 14 days prior to date of proposed conduction of the training course.

-- End of Section --